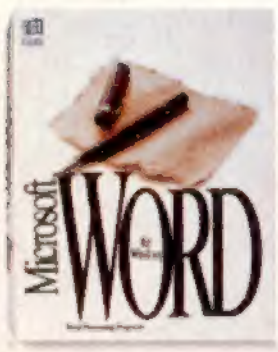
After all, they helped



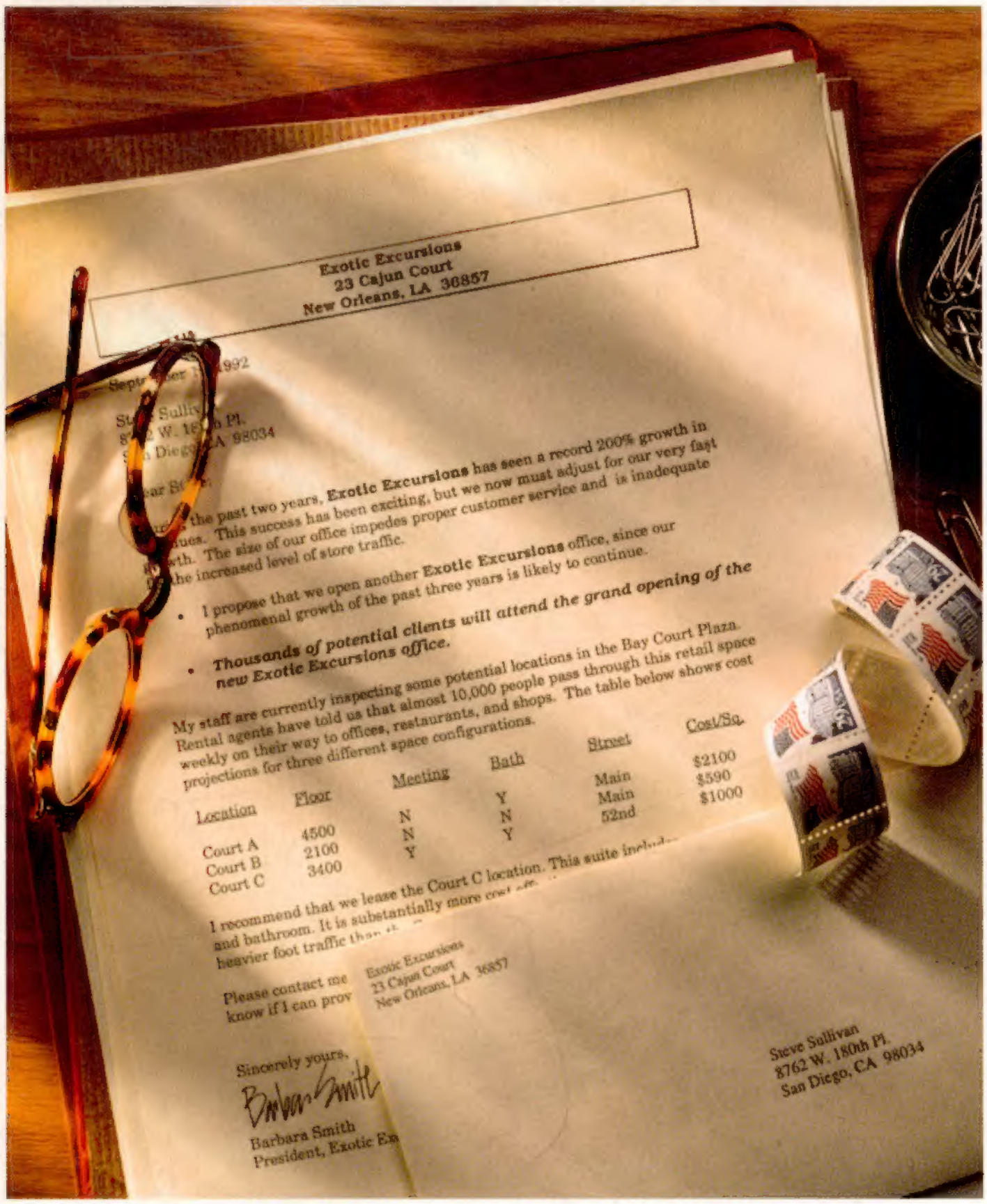
At last count, more than half a million WordPerfect® for DOS users have switched to Microsoft® Word version 2.0 for Windows.™ And there are plenty of good reasons why.

First of all, WordPerfect for DOS users helped us create Word for Windows, and actually made it easier.

Every week during the development of Word for Windows, we invited WordPerfect users to try it out on the things they do every day at work, like letters, memos, and even big reports. We call these types of sessions "usability studies."

It's an important part of the process we go through in developing all our software. Because "usability studies" help us find out the way in which people use their computers, and how we can make it easier.

Microsoft Word for Windows gives you one-step access to everyday tasks, like inserting bullets and printing envelopes.



In this case, we were able to design a number of innovative and time-saving features into Word for Windows that can make not only the things you do every day easier, but also the transition from WordPerfect.

For example, it reads WordPerfect files. Better yet, just type in your familiar WordPerfect commands and Word for Windows shows you the equivalent commands. So you can learn as you work.

We've also added a customizable Toolbar that gives you one-step access

*This three-dimensional bar chart, which was created in Word for Windows, shows the approximate total numbers of WordPerfect for DOS users who have switched to Microsoft Word for Windows each year. For more information inside t
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MURPHY'S LAW #18

IF THE PRICE IS A DREAM, THEN THE SERVICE AND SUPPORT WILL BE A NIGHTMARE.

intel inside

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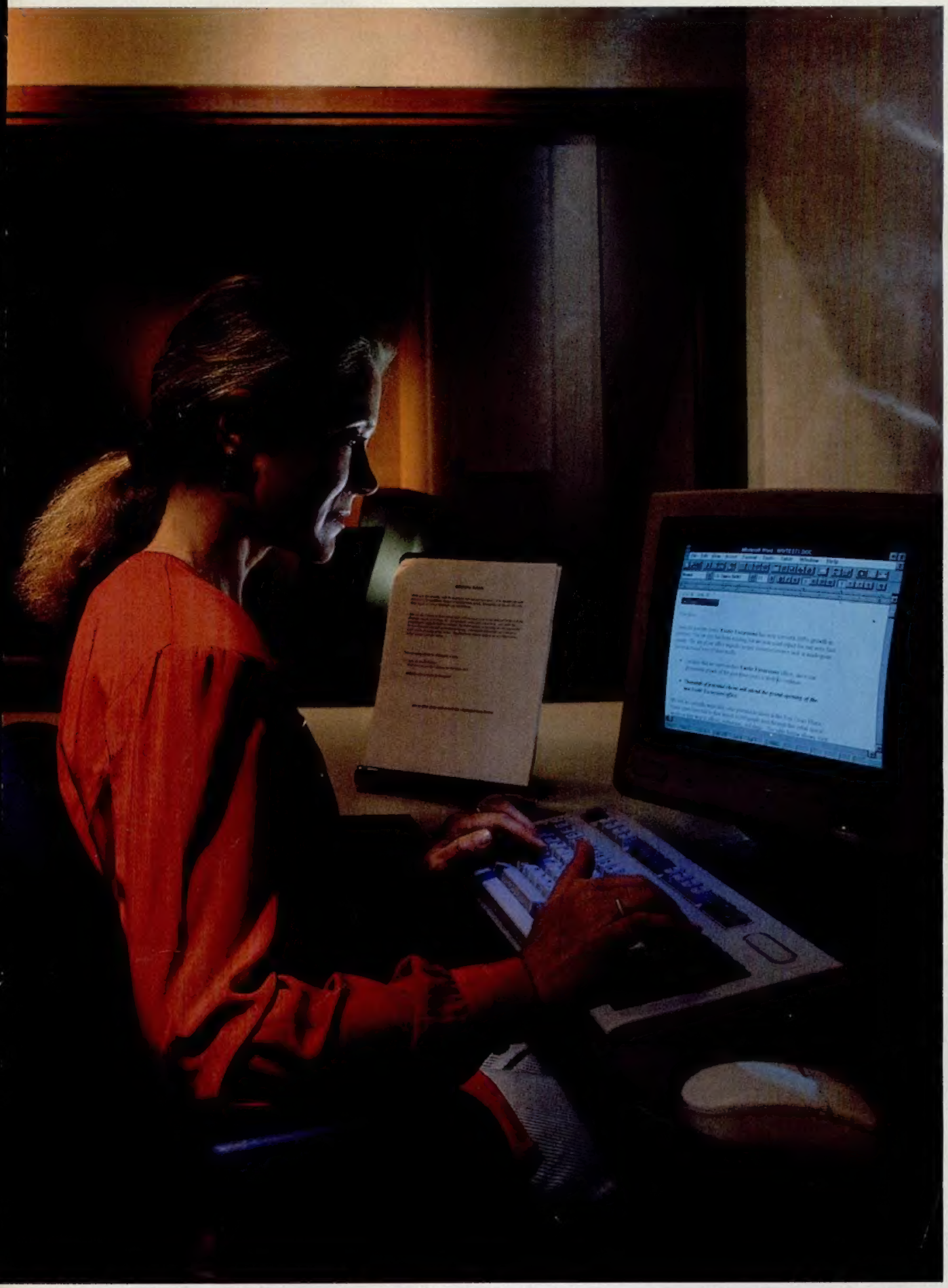
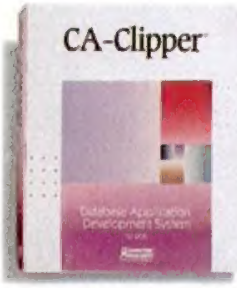


For Xba
Roads Le

It's been a very difficult and confusing couple of years for Xbase developers. Filled with uncertainty and doubt about the future. At times, some questioned whether Xbase even had a future.



But those days are over.

With the resources, experience and support of the world's leading database company behind it, and with the combined technological wealth of CA-Clipper,® CA-dBFast™ and Computer Associates, the future of Xbase has never looked brighter.

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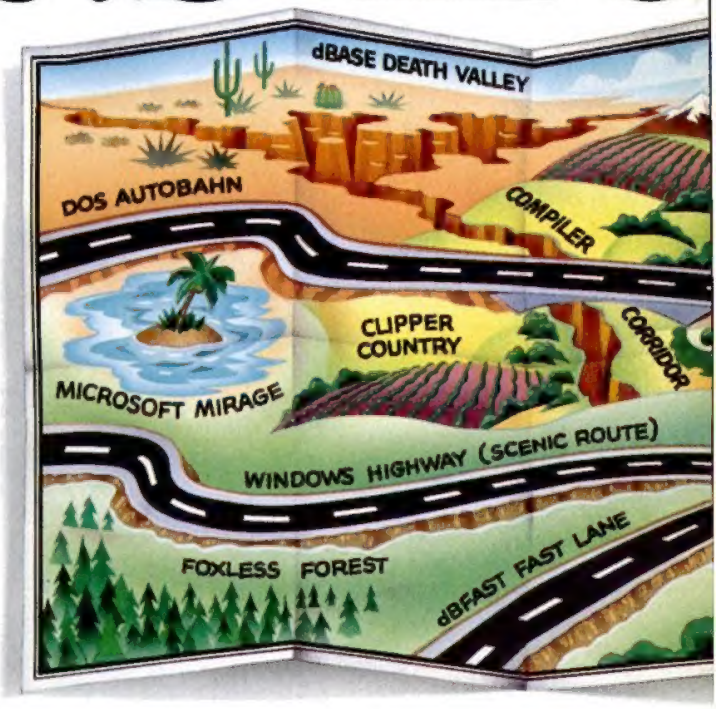
This new system will provide a fully object-oriented Xbase language, native code compiler, an IDE (Integrated Development Environment) and both DBF-style and client-server database support.

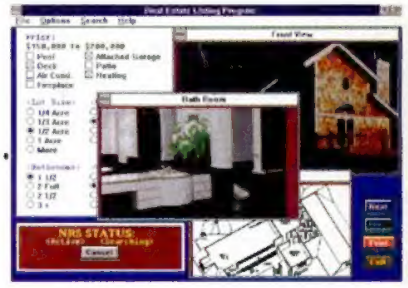
It will support Windows, Windows NT, OS/2 and UNIX. The complete product will be demonstrated at Fall Comdex and available for beta testing in the fourth quarter of 1992.

Two Easy Ways To Get There: Go GUI Today With CA-dBFast Or Go The DOS Route With OOP Via Clipper. Your Choice.

There are two migration paths to this ultimate Xbase system: The OOP (Object-Oriented Programming) path of



CA-Clipper and the GUI (Graphical User Interface) path of CA-dBFast with Windows support.



Both paths will provide immediate benefits and will protect and leverage the substantial investments you've made in Xbase.

Attention All dBASE IV Developers: Your CA-Clipper/Compiler Kit Has Arrived.

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se All ad To CA.

for has arrived. Introducing new CA-Clipper/Compiler Kit For dBASE IV. The easiest, quickest way in the world to compile a dBASE IV application.

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CA's Computing Architecture For The 90s.

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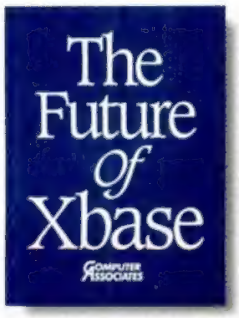
To get the complete story on The Future of Xbase, call for this special 30-page statement of direction.

It contains an Executive Summary as well as an in-depth discussion of Xbase in the 90s, CA's Open and Client-Server Architectures, Integrated Development Environment, Xbase migration plans and end-user tools.



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CIRCLE 105 ON READER SERVICE CARD

Inside

We've approached this issue with particular single-mindedness. This is the only issue of *PC Magazine* in 1992 completely devoted to a single topic: printers. We know that many readers look forward to our annual printer blockbuster with special anticipation.

Although this is our ninth annual printer issue, we haven't been resting on our laurels. We've revamped our tests to reflect advances in printer technology. You'll get a full explanation of the changes inside (see the sidebar "How We Tested the Printers"). We also tell you all you could possibly want to know about dot matrix, ink jet, laser, color PostScript, and network printers.

Getting the testing done on time and producing nearly 150 pages of reviews and performance tests is no mean feat. Our editors and technicians struggle against a ticking clock while vendors plead for one last late entry. The editor in charge needs the logistical skills of a Desert Storm commander, the nerves of a high-wire artist, and the patience of a psychoanalyst.

The master impresario of this issue is associate editor Jennifer Zaino, a six-year veteran of *PC Magazine*. Zaino, who wrote her master's thesis on Edith Wharton, says that one lesson from the author applied to this project: "civilized survival in the face of unrelenting natural forces." Her accomplishment is made more remarkable by the fact that she took over the hardware beat less than a year ago.

Zaino and PC Magazine Labs project leader Michael J. Zulich started planning this issue last February. The first requests for printers went out in May, and the last tests ended in September. Staff editor Catherine Kunkemueller, editorial researchers Eric Berlin, Camille N. Cline, and Susan G. Thomas, and intern Meredith M. Gadsby all helped shape what is undisputedly the most comprehensive coverage of printers you can find anywhere. The result is an issue we're especially proud to deliver to you.

—*Joel Dreyfuss*

The printer team: Michael J. Zulich, Jennifer Zaino, and Catherine Kunkemueller.

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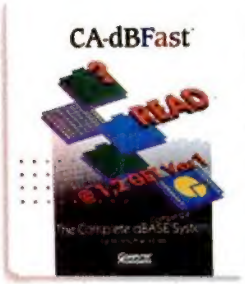
Photograph by Ralph Masullo

Attention All dBASE Users: Your Windows Have Arrived.



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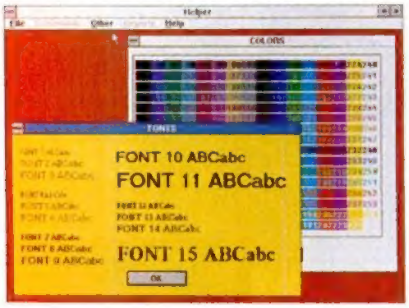

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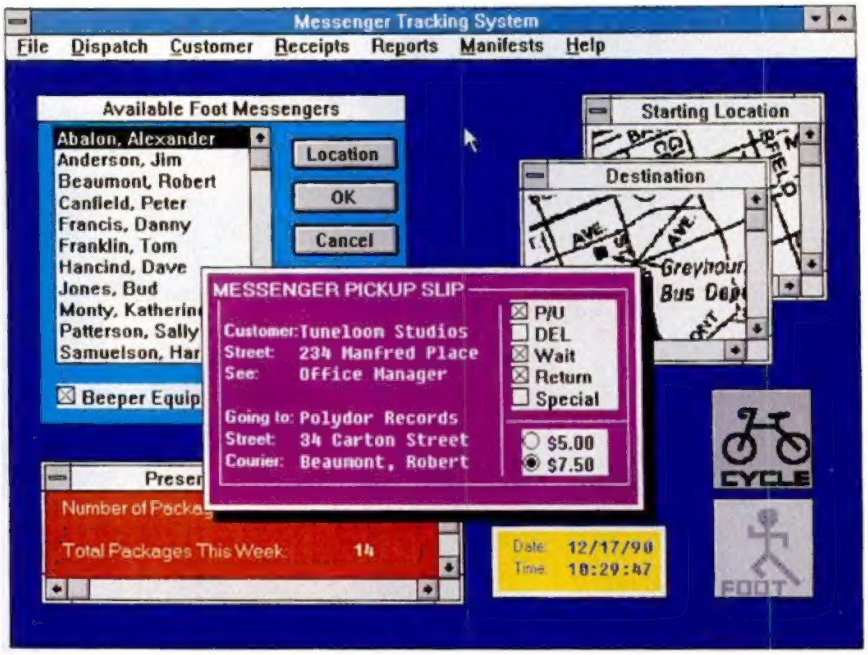

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See page 65

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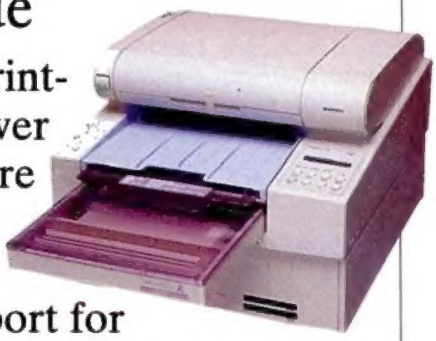
9th Annual Printer Issue



BY BILL HOWARD What's new in printers? Lots. For starters, try lower prices, higher resolutions, more RISC processors, expanding network options, better-quality color for ink jets, increased support for HP PCL 5 and PostScript, and photographic-quality reproduction of scanned images in PostScript. PC Magazine Labs tests 100 new printers, from low-end dot matrix to high-end color and everything in between ... **110**

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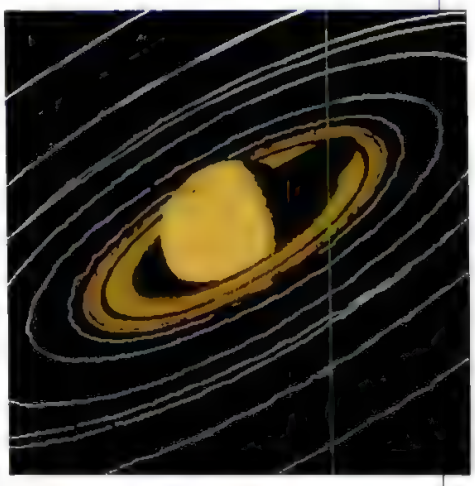
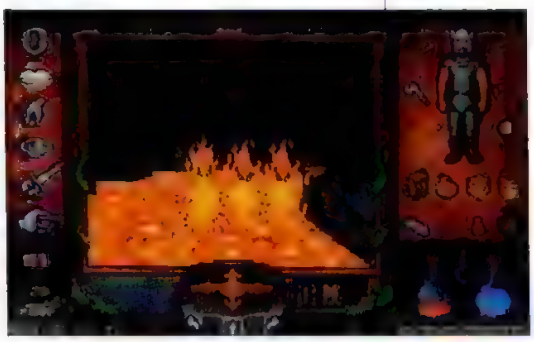


Explore the solar system without leaving your desk (page 481).



Ultima Underworld takes game players on a 3-D tour of the dungeon (page 594).

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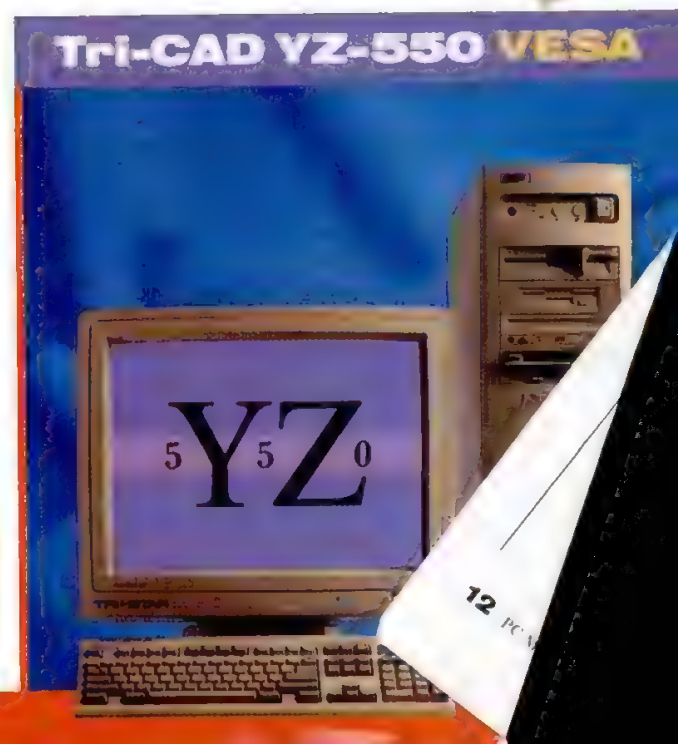

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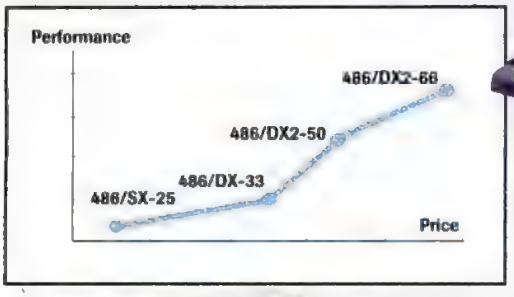

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101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard
DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse
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4MB RAM (to 32MB)	4MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM (to 32MB)	120MB Hard Drive
210MB Hard Drive	210MB Hard Drive	210MB Hard Drive	330MB HD, EISA/SCSI Cont.	9.4" VGA LCD Display, 640x480 w/ 32 gray scale
14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	14" VGA 1024x768 Non-Interlaced Color Monitor Local Bus Video	14" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	14" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	1.44MB Floppy Drive Built-In Track Ball
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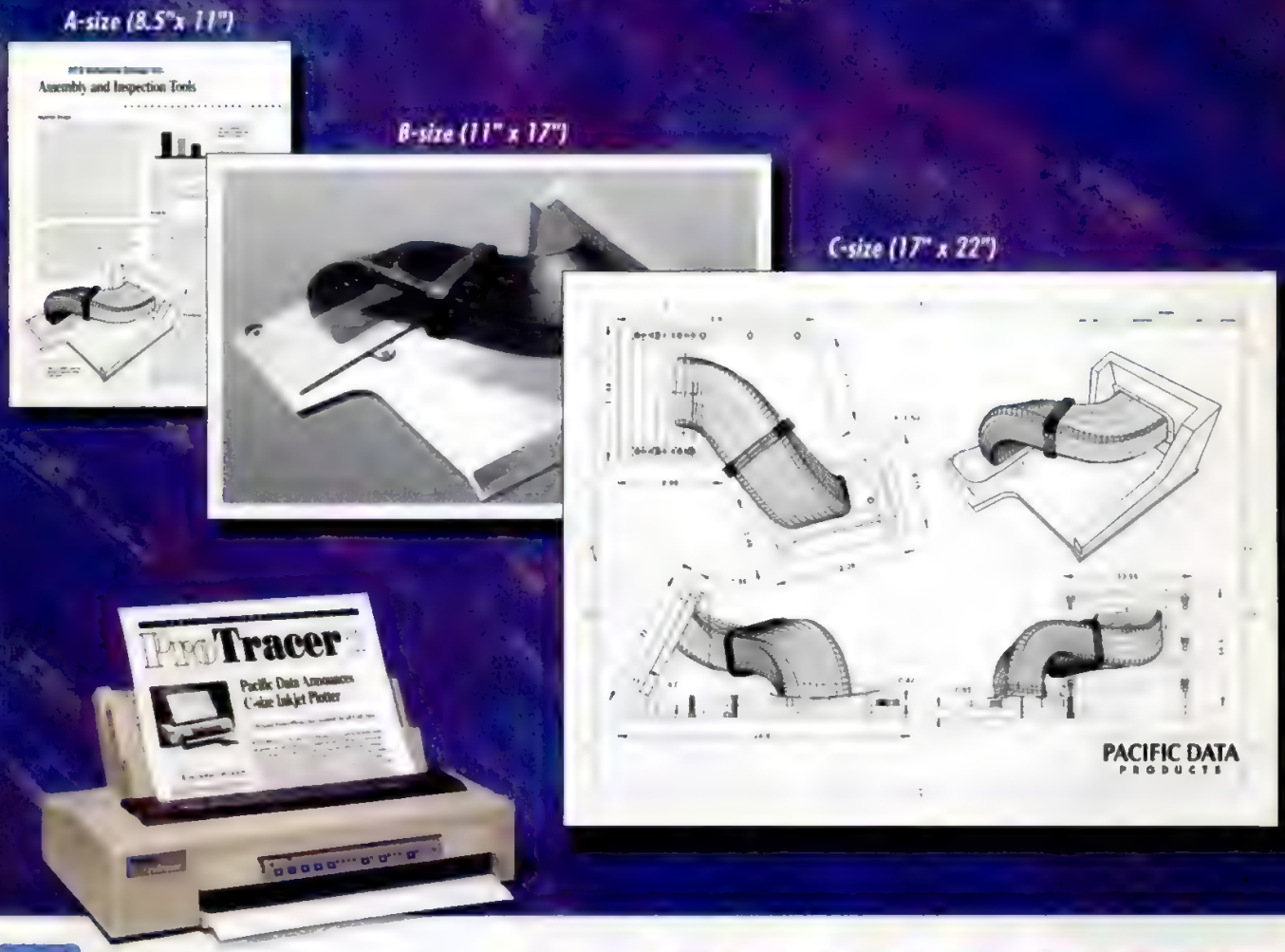

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Letters

WHO'S THE BONEHEAD, MR. MACHO?

When a new issue of *PC Magazine* arrives I usually go straight to the back to read the great programming tips that are in every issue. But John C. Dvorak's "The Bonehead vs. the Power User" (September 29, 1992) stopped my page flipping dead. Until industry insiders start realizing that everyone is a "power user" (limited only by money, not need), the type of hogwash Dvorak describes admirably will continue to pervade our working environments.

Crito Philippatos
Knoxville, Tennessee

I always read and enjoy John C. Dvorak's columns. However, in "The Bonehead vs. The Power User," I object to the identification of undesirable weakness with femaleness ("effeminate") and strength with maleness ("macho"). Such sexist gender stereotypes are offensive and unnecessary.

Ed DeJesus
Norwood, Massachusetts

Dvorak does it again! Of course, we know by now that his language is calculated as much to shock as it is to inform, but really, Windows an "effeminate" operating system? Macintosh (a platform vastly superior to the all-powerful PC for many applications) "sissified"? Those poor souls among us who don't use 486 DX/2s have no possibility of being counted as power users?

How many letters do you get that plead for some relevance for those of us that don't have vendors sending us goodies every day, and have to make do with our supposedly wimpy machines. The pathetic sales of OS/2 compared with Windows should clue Dvorak in to the fact that while OS/2 may be the hobbyist's new toy, Windows is where I have to turn if I want to get any work done.

Tom Birkland
Seattle, Washington

COMPETITION IS ESSENTIAL

PC Magazine represents itself as "The Independent Guide to Personal Computing." However, after reading Bill Machrone's "Kiss and Make Up" column (September 29, 1992), I'm motivated to express my doubts, at least as far as Machrone is concerned.

The Bonehead vs. the Power User

What does it take to be considered a power user these days?

The best thing that has ever happened to PC users is the competition between IBM and Microsoft. Would MS-DOS 5.0 be what it is if it weren't for DR DOS? Don't for a moment believe that Windows/NT would be available in 1993 if it weren't for OS/2 2.0. Let's hope that both products continue to develop for a long time.

The future is here now, and it will continue to get better as long as there is major competition.

Stephen E. Dawson
Downsview, Ontario, Canada

TWO APPS ARE BETTER THAN ONE

Jim Seymour's "The DOS-Windows Straddle" (September 15, 1992) is quite interesting. It's hard to believe that someone would recommend using the same application in DOS and Windows to get one result.

I think there is a better solution that can be offered. Software manufacturers need to stop being so excited by the looks of Windows products and realize that efficiency of entry is a significant part of using the software. Stop putting so many buttons on the screen and realize that DOS applications have merit too.

Kenneth R. Leebow
Marietta, Georgia

Jim Seymour's column made me realize I'm not the dunce that I feared I was becoming.

I've had Word for Windows 2.0 installed on my machine for about four months, but still use Word 5.5 most of the time for almost exactly the same reasons Mr. Seymour stated. I had begun to feel guilty about hanging on to both programs, but thanks to Mr. Seymour, I will now keep both versions and use each when appropriate in good conscience.

Eugene O. Frye
Marion, Iowa

FREE SOFTWARE!

I was more than disappointed with "Low-Cost Integrated Software: The New Synergists" (September 15, 1992). There wasn't one mention of the marketing ploy of bundling software or the nonexistent software product support that goes along with "gimme" software.

Any computer professional who has been on earth over the past four years knows that anyone buying any computer is going to get bundled or gimme software. *PC Magazine* should know that bundled software is nothing more than a sales hook to get someone to use something that they wouldn't use if they had to pay for it.

David Stimeling
El Segundo, California

Why are MS-DOS 5.0 and Windows 3.1 bundled with every computer you buy? What if I want DR DOS 6.0 or OS/2 instead?

Computer companies should give us a choice. We should have the opportunity to choose for ourselves which operating system we need on our computer.

Maybe this is why Microsoft claims such big sales of MS-DOS 5.0 and Windows 3.1: They're bundled with every computer!

C. Rioux
Gaspe, Quebec, Canada

Hype.

Saying bon voyage to your old spreadsheet is easier than you think.
EXCEL
Microsoft

Facts.

The Microsoft ad on the left has a lot to say about their spreadsheet, Microsoft® Excel. It also has a lot to say about *our* spreadsheet, 1-2-3.® But before you believe their ad, let's separate fact from hype.

The truth is, Microsoft isn't giving you all the facts.

Microsoft claims that Excel will read and write all your Lotus® 1-2-3 spreadsheet files and run your 1-2-3 macros unmodified.

Not true.

Excel can't read Allways files. It can't preserve 1-2-3 DOS formulas containing a 3D range. It can't convert a number of .WK3 files to Workbooks. And it can't run 1-2-3 macros containing commands from versions dating back to Release 2.01.

More hype? Their ad also tells you that a 1-2-3 user need only type in a 1-2-3 command and Excel will show the equivalent command.

Wrong again.

The fact is, Excel can't execute your familiar commands from Releases 2.2, 2.3, 2.4 and 3.1. Try pressing */, Range, Search* in Excel and guess what happens. Absolutely nothing.

The fact is, 1-2-3 for Windows offers the best transition from 1-2-3 for DOS. And complete compatibility.

If you're a 1-2-3 user, you've probably created and saved hundreds of 1-2-3 files, styles and macros. Face it, you'll certainly need to use them unmodified. Well, with 1-2-3 for Windows,™ you can. Because only 1-2-3 for Windows is able to read and execute *every* 1-2-3 for DOS file, style and macro. And only 1-2-3 for Windows—with its built-in Classic® Menu—lets you use all your familiar 1-2-3 commands.

What's more, only 1-2-3's 3D technology gives you easy access to 256 worksheets and lets you build true 3D formulas.

In comparison, Excel's Workbook is a limited imitation of true 3D. Try opening a large 1-2-3 3D file in Excel and see what happens. It might work. It might not.

Now ask yourself, why would a 1-2-3 for DOS user looking for the easiest way to move to Windows choose anything but 1-2-3?

The fact is, the new 1-2-3 for Windows includes the most asked-for improvements.

The new release of 1-2-3 for Windows includes performance enhancements (for example, it's now the fastest Windows spreadsheet for printing on PostScript® printers. It's also the fastest to launch). We've also added over 25 innovative new features, usability enhancements and programming tools.

New features include: customizable SmartFill which lets you create custom lists such as sales offices, department names, employee lists, etc., and use them again and again (a feature not found in Excel); SmartFormat, which gives you pre-defined table formats; 3D SmartSum for summing up columns or rows across and through your 3D worksheets; and the ability to create custom GUI-style dialog boxes.

The result?

1-2-3 for Windows is now one of the most powerful and easy-to-use spreadsheets ever developed.

Unmatched database capabilities in a spreadsheet.

If you're a spreadsheet user who needs to access external databases, 1-2-3 for Windows remains unmatched—particularly if you need relational capabilities. Excel's data access capabilities, on the other hand, rest on a third-party product that offers limited relational capabilities. Which explains why *Corporate Computing* (August 1992) recently wrote that *"for the experienced 1-2-3 database user, 1-2-3 for Windows with DataLens® is the front-end tool of choice."*

Join millions of spreadsheet users who prefer Lotus.

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After all, it only makes sense to base your spreadsheet decision on facts rather than hype.

Lotus 1-2-3 for Windows

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LETTERS

AMI PRO = UNHAPPY MATHEMATICIANS

Your glowing review of Ami Pro 3.0 (First Looks, September 15, 1992) overlooked one important feature that the program doesn't have: the ability to type multiline equations.

Even a moderate use of mathematics in text requires multiline equations. I have to begin looking at other programs since it appears Lotus won't be adding this feature anytime soon.

Paul Gronke
Durham, North Carolina

MEMORY, CHEAP? WHERE DO YOU SHOP?

John C. Dvorak said "memory is now dirt cheap" in "The Platform Shift is Now" (July 1992). This cannot go unchallenged.

The memory in my computer is the single most costly part. Furthermore, with those code-crazy software programmers out there, the required memory sometimes costs more than the software itself. Please don't tire me with the old saw that bytes per dollar is up. That's just meaningless given the increasing memory requirements (and precious hard disk space) that almost all the software being produced today demands.

Louis Lavoie
Plymouth, Minnesota

DON'T SUPPRESS YOUR PC PROTECTION

Your article "Power Protectors: Surge Suppressors Clamp Down on Spikes" (September 29, 1992) was timely. Our house and our computers had just been hit by lightning. True to form I had installed UL-approved surge suppressors on all the electrical equipment attached to these units, even the printers. In both cases, however, our modem lines were connected to the systems through unprotected connections. When the lightning hit, it knocked out a modem in each machine, our printer sharing device, and both hard disk controllers.

The reliance on a $150 power surge suppressor without a device to ground your phone lines gives you a false sense of security. I can vouch for that, and so can my wallet!

Andrew M. Keller
Ridgefield, Connecticut

Kudos on the excellent article about surge suppressors, but I kept asking myself why you requested EMI/RFI noise filtration as a part of your review criteria even though you mention several times in the article that it is more of a frill or marketing tool than a real concern for PC users. If so, why make it seem so desirable by making it a part of the criteria?

Relying on a $150 power surge suppressor without a device to ground your phone lines gives you a false sense of security. I can vouch for that, and so can my wallet!

It really makes the article appear as if it was written by several people who didn't communicate their ideas to each other.

Jerry Cole
Brentwood, Tennessee

• The introduction to the article said that "Early conversations with vendors led us to consider EMI/RFI filtration an important criteria for the review. The more we researched the topic, however, the clearer it became that EMI/RFI filtration is more a marketing tool than a real concern for PC users." It wasn't a consideration in our Editors' Choice selection, and it won't figure into future evaluations.—Ed.

DOCUMENTATION PROCLAMATION

Having spent the last several years in the personal computer industry, I have begun to notice that sloppy software documentation has begun to turn up in mainstream and mission-critical applications.

Incorrect and incomplete documentation is becoming the norm and should not be accepted. Perhaps you should refuse to award an Editors' Choice to any product whose documentation is incomplete or contains serious errors.

Gregory M. Kirk
Riverside, California

WHY THE SILENCE?

I would like to see you include OS/2 in your reviews of various DOS programs that attempt to solve the same problems. For example, when you review memory managers, you should review OS/2. It does many of the things that QEMM-386 and NetRoom do. When you review desktops for Windows, OS/2's Workplace Shell should be reviewed also. Even if people aren't interested in a 32-bit OS, they still might be interested in solving some of their old DOS problems.

Kirk Brackebusch
Bellevue, Washington

Since both OS/2 and Windows 3.1 were released in March, I have been waiting to see some of your helpful articles on setting up or using OS/2.

Each issue of *PC Magazine* contains several articles on various aspects of Windows from the technical to the operational, but I have yet to see anything like that on OS/2 aside from the initial reviews. The installed base of OS/2 easily justifies such attention, and your silence is puzzling.

Marvin P. Reem
Greenville, South Carolina

• We've been writing about OS/2 regularly, especially in the Programming and Solutions columns in the back of the magazine, since 1987, when OS/2 was first introduced and had an installed base of about 200. That installed base is finally growing, and *PC Magazine* intends to continue to address it.—Ed.

CORRECTIONS AND AMPLIFICATIONS

DeltaGraph Professional for Windows, Version 2.0 (First Looks, September 29, 1992), does have discontiguous row and column selection.

HOW TO WRITE TO PC MAGAZINE

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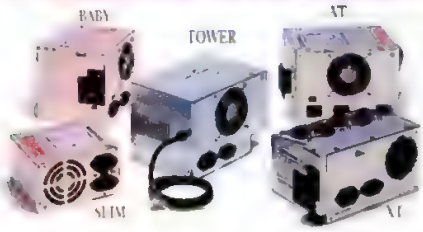

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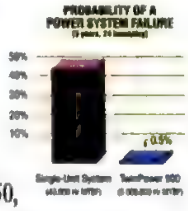

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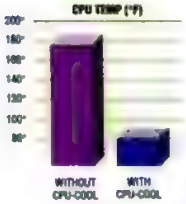

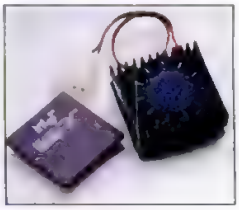

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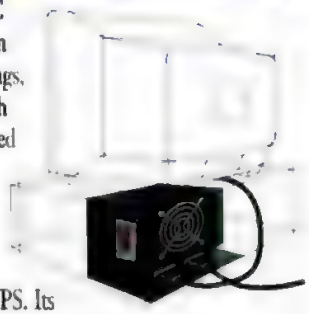

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On the Home Front, Again

Apple, Compaq, IBM target home market.

There are 70 million households in the United States that don't own PCs, but Apple, Compaq, IBM, NEC, Tandy, and several other major computer manufacturers still think there's an untapped market with enormous potential out there.

Despite previous failures to penetrate that home market, PC manufacturers are enlisting the help of the mass-merchandising channel—Sears, Circuit City, Staples—and promising plug-and-play capability and generous software bundles. While the average household income of families who own PCs is about $54,000, vendors are starting to sell into homes with incomes in the $30,000 to $35,000 range, according to Andy Bose, vice president of Link Resources.

Home shoppers will find few bargains in the mass-merchandising channel. They'll be able to spend as little as $1,000 to $1,200, but they'll get a very basic PC—a machine only powerful enough to satisfy first-time buyers. Apple's base-model Performa, with a black-and-white display, a 16-MHz 68030 processor, 4MB of RAM, and an 80MB hard disk, will sell for about $1,250.

IBM's entry-level PS/1 Consultant, with a 386SX/25 processor, 2MB of RAM, and a color VGA monitor, should come in at about $1,100. Both Compaq and NEC expect retailers to charge about $1,200 for 386SX/25-based systems with 2MB of RAM and color monitors. Compaq includes an 84MB hard disk; NEC, a 120MB hard disk.

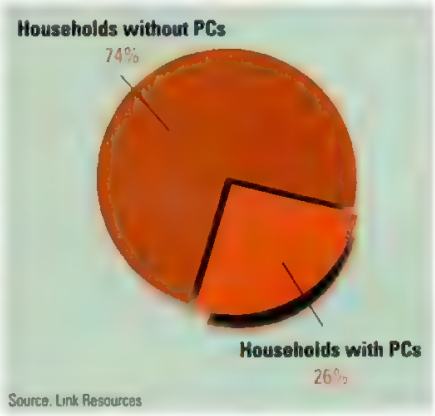
Multimedia capability still costs more, and is less widely available. Apple, Packard-Bell, and Tandy are betting customers will pay $2,000 to $3,000 for systems with built-in CD-ROM drives. "Most home office PC purchases are about $3,000," says Howard Elias, a marketing vice president at Tandy. "We believe we can use the $2,000 price point to generate another expansion of the home office market."

Tandy's Sensation includes a 486SX/25 processor, a 105MB hard disk, a CD-ROM drive, and a built-in modem for $1,999. The Apple Performa 600CD, meanwhile, will sell for about $2,500 without a monitor. Neither company can compete with Packard-Bell's $2,599 bundle, however: a 486SX/25 with CD-ROM, a 210MB hard disk, color VGA monitor, six DOS and Windows applications, and 12 CD-ROM titles.

Plug-and-play means you take your computer out of the box, fire it up, and get to work. Forget about loading software. All the IBM-compatibles are shipped with DOS and Windows loaded, and in many

Continues on page 32

1991 Home Market Penetration



Source: Link Resources

PC makers hope to reach the vast majority of U.S. households that still don't own a computer.

A New Way to Extend Battery Life

YOU'LL GET A CHARGE OUT OF Toshiba's latest developments in battery technology. Two years ago Toshiba developed nickel hydride batteries to replace those poisonous nickel cadmium cells that most portable computers use. Now Toshiba has teamed up with Asahi Chemical in Japan to develop lithium ion storage batteries (LISB), which are appreciably smaller and even more powerful.

Lithium batteries are not new. NEC used them in the 1988 UltraLite but changed to nickel cadmium because of the expense and inconsistent discharge of the lithium batteries. Besides, pure lithium batteries had other barriers, such as being banned from airplanes because they might explode. (NEC's composite lithium batteries posed no threat.)

Nickel cadmium batteries are better, but they're not perfect either. Nickel cadmium has an annoying memory effect that makes the battery think it's fully charged even when it's not. Cadmium is a toxic heavy metal that may leak into the water table if the battery is not disposed of properly.

Toshiba and Asahi's new company, called A&T Battery, claims that lithium ion batteries have twice the power capacity of nickel cadmium and carry three times the voltage at a reduced weight. They can be recharged up to 1000 times—giving them twice the cycle life of nickel cadmium and nickel hydride, and the metals are not toxic.

It's too soon to tell when they'll show up in notebooks.—*Christopher Barr*

Banyan Spreads Global Naming

FAR BEHIND COMPETITORS NOvell and Microsoft in market share, Bany has always been ahead of them in one technology: global naming se Banyan's StreetTalk, which mana lists of users, has won kudo company's VINES network o tem. Novell and Microsoft h gun adding similar services

Pipeline *By Gus Venditto*

Windows Takes Root in Hardware

In coming months, the second level of Microsoft's long-term strategy for Windows will start to play out, as several versions of the environment appear on different types of hardware.

Windows for Workgroups attempts to extend Windows' reach into networking, and while it's an ambitious effort, it is aimed only at the desktop PC environment that Microsoft knows so well.

The most ambitious version of Windows yet is NT, which was designed to be ported to non-Intel platforms. It will be available next year, but several years could pass before we know if NT will successfully cross over to different platforms, especially emerging RISC systems.

PHOTOGRAPH BY PETER GREGORE

A less closely watched adaptation of Windows will be getting its first test in the market before NT is even introduced. Modular Windows, a reworking of the Windows 3.1 core, lets hardware developers create software modules that can change the way Windows works.

The first example of Modular Windows is in Tandy's new VIS (Video Information System), which lets home users run multimedia software without having to buy a PC (it uses your TV as a monitor). The system will be marketed as the educated family's alternative to Nintendo. It will run Compton's Multimedia Encyclopedia, a multimedia Bible, and adventure games such as Chuck Yeager's Air Combat.

The technology has far broader implications than challenging Super Mario Brothers for dominance in the den. Anyone who's developing interactive training tools or point-of-sale demo units will want to consider systems built for the platform because it's designed to integrate video, sound, and interactive input devices, such as touch screens and remote control. There are many ways to use Modular Windows; the only question is whether there's a demand for systems capable of highly programmed interactive video. If there is, Microsoft will be able to make the enormous leap from business systems to the much larger consumer entertainment and education market. And while Microsoft believes it will someday make that leap, AT&T, IBM, Time-Warner, and a host of other companies are poised to stop it.

Of more immediate interest to PC users is a further refinement of the Modular Windows concept: Windows in ROM. Next year, systems that boot up in Windows and look to the hard disk only for accessories and drivers will be introduced. That will make it possible to build even smaller systems, such as handbooks, at lower cost because the demands on hard disk performance will be lessened. Of course, if Windows can successfully move into ROM, it will be virtually impossible for any competing operating environment to dislodge it from a position of leadership.

Gus Venditto is the author of the PC Magazine Guide to Windows *and editor-in-chief of the magazine* Windows Sources.

is one-upping them by porting StreetTalk's more sophisticated technology to their environments. The first entry in Banyan's Enterprise Network Services line, ENS for NetWare, is slated to ship in December, with prices ranging from $295 for a 5-user version to $3,495 for 250 users.

Banyan's StreetTalk global naming service allows a system manager to update user directories easily across multiple servers when adding new users and network resources, changing security profiles, and modifying group definitions. Global naming services also make it simpler to group together users and resources at different sites.

By integrating StreetTalk with the Bindery (NetWare's database of user information), NetWare system managers will no longer have to update this information on a server-by-server basis. Although Novell has its own NetWare Name Service add-on product, it is not as powerful as StreetTalk in letting users access resources such as shared printers. ENS for NetWare will also work across whatever version of NetWare the servers in your company are running, whether it's NetWare 2.*x* or 3.*x*. Banyan is also working with Novell to ensure that the upcoming NetWare 4.0, which will also contain its own global naming service, will support ENS.

Networks running ENS for NetWare will retain the same look and feel as NetWare. Typically, you'll have to add only one ENS server for each site. It will support up to eight NetWare servers and give you transparent access to remotely located NetWare servers.

Banyan also plans to add ENS to other networks, including Microsoft LAN Manager and IBM LAN Server. Its VINES for SCO Unix product already ties in Unix hosts. Although Microsoft has built a global naming service for LAN Manager, it lacks many of StreetTalk's enterprise capabilities. However, Microsoft has plans to add more enterprise features to its upcoming LAN Manager for Windows NT and even to Windows itself.

Banyan's ultimate goal with its ENS series is to give users and administrators transparent access and simplified management across enterprise networks, no matter what network operating system is running on individual servers.

—*Michael Cohn*

New Input Device Feels the Pressure

WILL ROGERS MAY HAVE NEVER met a man he didn't like, but we sure can't say the same about the new wave of built-in pointing devices for portable systems. The truth is, most of them are misplaced, too big, or just too awkward to work well in tight spaces.

With graphical interfaces all the rage, most notebook and subnotebook makers are scrambling to design a pointing device—any kind of pointing device—into their systems. They may get help from a tiny device called a force-sensing resistor (FSR).

A force-sensing resistor registers pressure.

An FSR is a postage stamp–size device that, when pressed, senses *x*, *y*, and *z* coordinates that can be translated into mouse movement. The *z* axis can be used to measure pressure or velocity. The appeal of FSRs is that, because they are so thin, they can be installed in small machines where real estate is at a premium. The resulting devices

Photography by: Thom O'Connor

can be tiny or, in some cases, just about invisible.

Instead of gouging a half-inch out of a case, an FSR can be built into a subnotebook, rising only a quarter inch above the case. The pointing device acts much like a squashed joy stick, with your finger applying the pressure for direction and cursor speed. This is the technology behind the J-Key keyboard mouse brought out by Home Row.

Interlink Electronics (805-684-2100), the developer of FSRs, has introduced a tiny mouse based on FSR technology. Called the PortaPoint, it's a .5-inch-high device that uses finger pressure to direct the cursor. It's one of the smallest pointing devices we've seen yet, and it plugs into an ordinary mouse port or serial port.

—Christopher Barr

Top Retail Software

Current ranking	Last issue	Product/ Company
1	1	**WordPerfect 5.1 for DOS** *WordPerfect Corp.*
2	7	**Microsoft Windows 3.1 Upgrade** *Microsoft Corp.*
3	3	**QEMM-386 6.0** *Quarterdeck Office Systems*
4	4	**Microsoft Windows 3.1** *Microsoft Corp.*
5	5	**Microsoft DOS 5.0 Upgrade Kit** *Microsoft Corp.*
6	—	**Quicken 6.0** *Intuit*
7	6	**WordPerfect 5.1 for Windows** *WordPerfect Corp.*
8	2	**Stacker 2.0 Software Only** *Stac Electronics*
9	8	**Procomm Plus 2.1** *Datastorm Technologies*
10	9	**Office for Windows 3.0** *Microsoft Corp.*
11	—	**Word for Windows 2.0 Upgrade** *Microsoft Corp.*
12	10	**Word for Windows 2.0** *Microsoft Corp.*
13	—	**Lotus 1-2-3 2.4** *Lotus Development Corp.*
14	11	**LapLink Pro 4.0** *Traveling Software*
15	12	**The Norton Utilities 6.01** *Symantec*

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending September 19, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

PC Executives Champion Causes

PHILANTHROPY HASN'T ALWAYS been a top priority for the PC industry, but this fall some computer executives are taking a more active role in championing causes. Presidential politics, science departments, and missing children are on the agenda.

Thirty high-tech business executives, many of whom are lifelong Republicans, recently endorsed Democratic presidential candidate Bill Clinton. Among the most famous are Apple CEO John Sculley, Lotus cofounder Mitch Kapor, Oracle CEO Lawrence Ellison, and outgoing Hewlett-Packard CEO John Young. Sculley, outspoken in his views on industrial policy, says he believes Clinton "understands the systematic connection between education, technology, and the new knowledge-based economy."

While staying out of politics, Microsoft CEO Bill Gates is helping out universities. In August, he donated $6 million to Stanford University to complete its Information Sciences Building, which will be named after Gates. He chose Stanford because he considers it "one of the five best computer science schools in the country." Last year, Gates gave $12 million to the University of Washington to establish the School of Medicine's molecular biotechnology department, with genetic biologist Leroy Hood at the helm. Gates is also a member of the United Way's national board.

Micrografx president George Grayson is absolutely zealous about the role he believes the PC industry should play in shaping society. He has organized a Fall Comdex event that promises to show what Hollywood and Silicon Valley can do when they put their heads together for a good cause, the National Center for Missing and Exploited Children. Grayson's goal for The Grand Scientific Musical Theater at Micrografx's Chili Cook-Off is twofold: to provide a glimpse of the convergence of information and entertainment industries, showcasing such emerging PC technologies as 3-D virtual audio (which will help you experience the Indianapolis 500, for example, as if you were at the auto race), and to prod the PC industry into funding a national technology network so law enforcement agencies can share information on missing children.

Grayson has collected an impressive list of supporters. On the PC side, there's Borland, Hewlett-Packard, IBM, Intel, Lotus, Microsoft, NCR, Novell, and Ziff-Davis Publishing (publisher of *PC Magazine*), among others. And from the music industry, performers at the event will include Graham Nash (of Crosby, Stills & Nash), Jeff "Skunk" Baxter (Steely Dan and the Doobie Brothers), Jon Anderson (Yes), Lee Thornburg (Tower of Power), and Scott Page (saxophonist for Pink Floyd), who is producing the show. To order tickets ($50 each) for the November 17 performance in Las Vegas, or to make a contribution to the Center, call 703-516-6158.

Graham Nash (right) will be one of the music industry heavyweights performing at Micrografx's Chili Cook-Off.

—Mary Kathleen Flynn

Where Am I?

ANCIENT MARINERS USED TO NAVIgate their ships by the position of the stars. Modern sailors also steer with help from the position of heavenly bodies, but theirs are actually manufactured satellites. Now you can use this technology and your notebook computer to find your exact location anywhere in the world.

The Global Positioning System (GPS), famous for guiding ground troops through the trackless wastes of Kuwait and Iraq during Desert Storm, relies on a series of orbiting satellites that contain atomic clocks accurate to one billionth of a second.

GPS receivers accept signals from the orbiting satellites. By comparing the stat position of the satellites with their predi position and then calculating their di based on the timed signals, the rece determine their own location— an accuracy within 60 feet of th sition.

The early GPS product

Photography by: Jay Blakesberg/Retna LTD

locations in terms of latitude, longitude, and elevation, but the feature set has rapidly become more sophisticated. Aviation and marine models can display course headings to a desired destination, ground speed, and other useful information. Commercial airliners have systems that display current position superimposed on a map using a CRT on the instrument panel; these systems can cost from $20,000 to more than $100,000. Small-plane pilots and pleasure boaters can get similar capabilities for a fraction of the cost by connecting a GPS receiver to a standard laptop computer; the price comes to less than $6,000, including the computer.

The best news for PC users is that laptop map programs based on GPSs are becoming available for ground-based use. The DeLorme GPS MapKit is a $10,000 unit that contains a GPS receiver and integral CD-ROM drive, which can be used to display a moving map on a laptop computer running Windows 3.0 or later. The system includes DeLorme's Street Atlas USA CD-ROM and top-end XMap Professional software, giving you access to details ranging from street addresses to topographical elevations.

If you want to create your own system, you can get RealTime MapInfo for DOS from MapInfo Corp. This $2,495 product is a development tool you can use to develop your own moving map applications. The product can take position information from a GPS receiver and display the corresponding street and address information for that location. You can also merge information from other databases, which can be stored in dBASE-compatible files.

Eventually, you can expect to see the role of the laptop taken over by dedicated components. One pilot program sponsored by GM and AAA Motor Club has installed systems in rental cars in the Orlando, Florida area. These systems use moving maps based on data from ETAK to provide the driver with information on navigation, route selection to specific destinations (such as hotels or attractions), and advisories about traffic congestion or other delays. Toshiba already has a product available in Japan as an aftermarket option for new cars.

—Alfred Poor

Global Positioning System

Briefs

TOUGHER FLOPPY DISKS OPTIMIZED FOR portable computing are starting to appear. Maxell has announced Super RD II floppy disks, which incorporate a shock-resistant shutter mechanism designed to stay on, no matter what. And if foreign particles from the drive heads make contact with the magnetic media, a multi-layer cleaning liner will remove them.

MULTIFUNCTION DEVICES THAT COMBINE faxing, copying, scanning, and printing capabilities continue to make news. First came Okidata's DOC-It, and now Digital Design (800-733-0908) has introduced its Gateware 3370, which does all of the above and throws in a 33-MHz 486 system as well, all for about $4,000.

RIGHT SIZING IS MORE THAN JUST A business buzzword; it's a fact of life for some venerable PC vendors. IBM's announcement that it's eliminating 40,000 jobs, more than twice the estimates of most analysts, came on the heels of Wang's attempt to climb out of bankruptcy with a slimmed-down, reorganized staff. The IBM cuts will result in a 12 percent workforce reduction.

SOFTWARE SALES WERE UP NEARLY 20 percent to $1.49 billion in the second quarter, according to the Software Publishers Association. Sales of Windows applications were up 181 percent over the same period last year, reaching $526 million.

And Europe is buying more Windows apps than ever. Software sales to Western Europe were up 19 percent to $373 million, and 54 percent of those sales were Windows apps. Almost a third of total sales were to Germany and Austria.

—Don Willmott

Home PCs

CONTINUED FROM PAGE 29

cases with integrated packages (Microsoft's Works for Windows or Spinnaker's PFS:WindowWorks are two favorites), along with software for at least one on-line service (IBM, NEC, Tandy, and ZDS bundle Prodigy). Some higher-end systems even include such favorites as Intuit's Quicken and Broderbund's New Print Shop.

Apple and IBM have also tried to make these computers easier to operate. The IBM PS/1s, for example, come with PS/1 Index, an on-line guide to using the system. The systems are also designed to be easy to configure when a new piece of equipment is added. The Performa comes with At-Ease, a simplified desktop for System 7 that lets users launch applications from one location.

Manufacturers are hoping ease-of-use will attract first-time PC customers, since prices are not much lower than those found in other channels. Now you can buy PCs from IBM and Apple at Sears, instead of from Zeos and Gateway through the mail.

—Julie Cohen

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- Flash BIOS
- 8 Open Expansion Slots (7 ISA and 1 Local Bus)
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First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

■ **Multimedia**

Microsoft Sound System Gives Windows a Voice

BY JOHN R. QUAIN

How will multimedia be used in business? No one is totally sure yet, but Microsoft is providing one important tool to make it more accessible: the Windows Sound System.

With a voice annotator, a talking proofreader, and voice command software, it's difficult to judge whether corporate customers will regard the package as a welcome way to improve communication or as a raucous office irritant. But Microsoft has created a unique hardware and software package aimed specifically at business users who don't want to play games, compose MIDI tracks, or spend a lot of money.

The $289 Windows Sound System includes a 16-bit sound card, a microphone, headphones, and a group of Windows 3.1 sound utilities. The ISA sound card manages basic recording and playing back of 16-bit, 44-kHz stereo sound. Its Analog Devices controller does the analog-to-digital and digital-to-analog conversion and manages different sound sources.

Connections to the card include a monaural microphone input, a stereo line input, a stereo headphone jack, and stereo line-outs for hooking up an external amplifier or self-powered speakers.

Interestingly, because the card lacks a MIDI or joystick port, the Windows sound card is not MPC-compliant. An onboard Yamaha four-operator YMF262M FM synthesis chip does allow the playback of MIDI files, but those users who need to create sophisticated multimedia presentations or add MIDI sounds will have to look for other options.

AUDIO: *The sound system plays and records.*

The one glaring omission on the sound card is the absence of an internal audio connection. This all but prevents you from hooking up an internal CD-ROM player to the card, though an external CD-ROM player can be connected via the stereo line input.

Microsoft refuses to quote the standard audio specifications for its sound card, but hands-on tests proved it to be capable enough—given its audience. There's plenty of power to drive speakers, though at medium to high volumes a low background hiss or noise from the card is often detectable. Other 16-bit audio cards installed in our test system produced somewhat less or no background noise at all. Microsoft correctly points out that the amount of such interference depends on the particular PC.

• *Continues on page 38*

■ **PCs**

Digital's New PCs: Built Rugged, Priced Right

BY BRUCE BROWN

Maybe now you'll buy a DEC PC. Digital Equipment Corp.'s new line of modular desktop computers shows that the mini and mainframe giant has finally figured out how to be competitive in the PC business.

Earlier generations of Digital's personal computers (such as the mid-1980s Rainbow) suffered from poor sales due to combinations of non-IBM-compatible designs, high prices, and distribution and sales strategies out of tune with the mainstream PC market.

SLIMLINE: *The DECpc LP series.*

Digital's new family of six PCs features modularity, upgradability, and aggressive pricing. While not as low-priced as systems from some of the direct-channel vendors such as Zeos and Gateway, Digital's new PC offerings present credible prices and service competition to new "value-priced" computers from Compaq, Dell, and IBM.

To build sales volume, Digital has added telephone and catalog sales to their distribution channel mix, a mix that also includes a direct sales force and authorized resellers.

To insure international system compatibility and availability, and to keep costs down, Digital manufactures most of the parts for the systems at one plant and then ships the parts to integration centers around the world for final assembly.

To make sure the systems are supported right, Digital has instituted a high-profile service

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Sound System

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VOICE SOFTWARE

The real benefits of the Windows Sound System are its software components. Requiring approximately 9MB of disk space for complete installation, they comprise the most complete and easy-to-use single-source business sound toolbox currently available. They include Music Box, Volume Control, Recording Control, Sound Finder, SoundScapes, Quick Recorder, Proofreader, and Voice Pilot.

For playing audio CDs, Music Box 2.0 has been rewritten for Windows 3.1 as an MCI application. This reduces some of the system overhead the previous version demanded. It's a streamlined version of the original CD player control panel and is the only application here that is compatible with other sound boards.

The volume control feature manages independent volume and balance controls for the card's audio sources, while the recording control adjusts the input level of the microphone or line source. Sound Finder enables you to play back several sound file formats, including Apple, Next, and Sound Blaster. SoundScapes is an audio screen-saver that plays a number of sounds such as chimes or birds when the screen blanks.

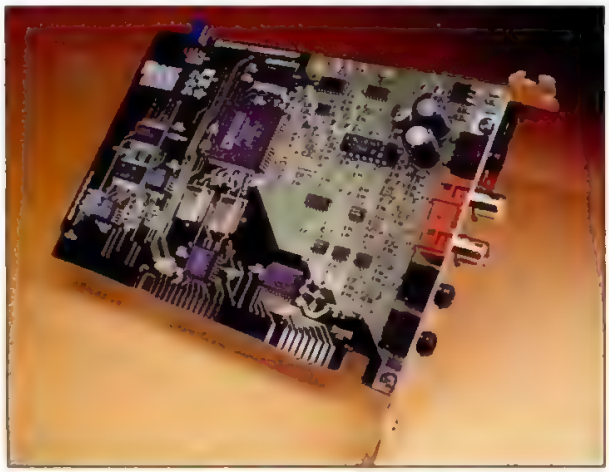
You'll find the most impressive and useful software components to be Sound System's the Quick Recorder, the Voice Pilot, and the Proofreader.

Quick Recorder lets you record stereo or mono .WAV sound files in 4-bit, 8-bit, or 16-bit sample sizes using 11-kHz, 22-kHz, or 44-kHz sample rates. The program alerts you to how much disk space will be needed according to the quality level you select. The highest quality setting, for example, is 16-bit stereo audio recorded at 44 kHz. It requires 176K per second of disk space. For simple voice recording, you can use mono 8-bit 11-kHz sampling. Though your voice will sound a bit tinny at this rate, it only takes about 11K per second.

TALKING ANNOTATIONS

Adding voice annotations to a file is nearly as easy as sticking down a Post-it note. You can insert sound bites into spreadsheets, letters, or e-mail simply by inserting sound objects into documents or dragging and dropping icons representing a previously recorded piece of material. An icon of your choice marks the audio annotation, and it can be labeled ("Watson, I need you!"). The recipient then double-clicks on the icon to play back the message.

Quick Recorder also includes several editing tools and special effects. It doesn't offer all the sophistication of a product such as Turtle Beach's Wave for Windows, but there are plenty of effects you can use for voice annotation or simple "audio clip-art." Options include fade in/out, echo, speed adjustment, and "trim silence." The last item automatically cuts out pregnant pauses, saving space and time (but often sacrificing at least some intelligibility).



SOUNDING BOARD: *The bundle includes a 16-bit sound card.*

PROOFING SPREADSHEETS

Although it is currently limited to working with Excel 3.0, 4.0, and Lotus 1-2-3 for Windows spreadsheets, those who must constantly check numbers and dates will be pleased by the inclusion of Proofreader. When you select "proof" from the Excel toolbar, a female voice reads the contents of each cell aloud, enabling you to check the cell's contents against another copy. It's a pleasant, if antiseptic, voice whose speed and pause lengths can be altered to your taste.

The Proofreader understands over 170 terms. When cells with unrecognized words are encountered, however, the automated voice will announce it as "empty." To circumvent this problem, you can add your own recorded words to the dictionary.

VOICE RECOGNITION

Voice Pilot is Microsoft's demonstration of the ultimate PC interface: voice recognition. Using this program, you can speak into the microphone to issue basic Windows commands for 15 different programs, including Word for Windows, PageMaker, and WordPerfect for Windows. Commands such as "next," "minimize," or "previous window" are recognized. But don't throw away your mouse just yet. Only very basic Windows commands are understood, and it's not entirely foolproof.

Generally, it takes some practice to speak at the correct volume and speed for the program to understand you. When it fails to recognize a command, a question mark appears below the icon. If you find the program often doesn't respond to the sound of your voice, you can train it to recognize your particular intonations by reading words to it and adjusting how closely the sounds must match its catalog to execute commands. Moreover, if the command you want isn't in the program's vocabulary, you can add it yourself.

EASY INSTALLATION

Installation was obviously of primary concern to Microsoft, and its efforts are laudable. The automatic installation program alerts you to potential conflicts with WIN.INI and SYSTEM .INI entries and graphically pinpoints the audio card's settings—a welcome relief for beginners.

No other single PC product is more likely to conjure up images of *2001: A Space Odyssey*'s HAL computer than the Windows Sound System. However, given the software's lack of compatibility with other popular sound boards, many current audio card and MPC users will be disappointed.

Even though the included sound card doesn't establish new audio quality marks for PC sound or have all the features true audiophiles desire, the Window's Sound System's overall ease-of-use and practicality make it a fun option for business users who want to experiment with sound. □

FACT FILE

Microsoft Windows Sound System, Version 1.0

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-429-9400, 206-882-8080

List price: $289, including 16-bit audio card, microphone, headphones, and software.

Requires: 2MB RAM, 9MB hard disk space, Microsoft Windows 3.1, 16-bit ISA slot.

In short: An entertaining and useful sound card and software combination that lets you voice annotate files, proofread spreadsheets, and drive Windows with your voice

431 ON READER SERVICE CARD

Digital PCs

CONTINUED FROM PAGE 37

and support program that includes standard on-site service, which is provided by Digital Equipment Corp. employees rather than by a third party during the standard one-year warranty. Toll-free technical support is also available.

SIX SYSTEMS

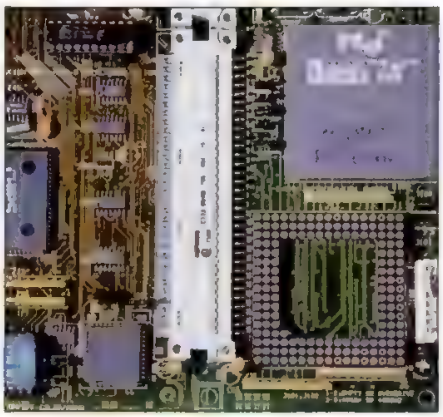
The DECpc LP lineup consists of six systems. Base configurations start with an entry level, nonupgradable 33-MHz 386SX system ($899) and move up to upgradable 40-MHz 386DX ($1,549), 25-MHz 486SX ($1,649), 33-MHz 486DX ($1,849), 50-MHz 486DX2 ($1,999), and 66-MHz 486DX2 ($2,199) systems.

Two standard 14-inch color displays are available: a .29-mm dot pitch unit with 640-by-480 resolution and a VGA monitor ($350), and a .28-mm dot pitch display with 1,024-by-768 resolution, (noninterlaced) and a low-emission Super VGA monitor ($450).

All of the LP systems come in a low-profile case that measures 3.5 by 16 by 15.6 inches (HWD). Common features across the line include three 16-bit ISA expansion slots, four drive bays (for three 1-inch high 3.5-inch drives and one 5.25-inch half-height drive), two serial ports, one parallel port, PS/2-style keyboard and mouse ports, and a 15-pin VGA analog port.

Also included with all the systems are a 3.5-inch, 1.44MB floppy disk drive; a 145-watt power supply with an extremely quiet, temperature-sensitive variable-speed fan; integrated video; floppy and IDE hard disk controllers; a 101-key keyboard; a mouse; DOS 5.0; and Windows 3.1.

The low-profile case is solidly constructed and its design quality shows up in the relatively easy access it provides for adding memory upgrades or additional drives. The power switch on the front of the case pushes a long rod that reaches back through the inside of the case to connect with the power supply. This design element is sometimes flimsy when implemented in some systems, but in the DECpc LP machines the rod is enclosed to prevent flexing and reduce breakage.



SNAP TO IT: *The segmented motherboard.*

The very low-cost 33-MHz 386SX model offers limited upgradability; the only thing you can do to it is add a math coprocessor chip. This model doesn't have the higher performance components and modular upgradable motherboard design found in the five systems with faster CPUs. It does have on-board video circuitry with 512K video RAM and supports up to 1,024-by-768 resolution; its other standard features include a 64K RAM cache, 2MB RAM expandable to 14MB, and a 52MB hard disk.

Each of the five faster DECpc LP systems, from the 40-MHz 386DX through the 66-MHz 486DX2 models, share a motherboard that uses a snap-on daughterboard containing the computer's CPU, math coprocessor or CPU upgrade socket, and RAM cache. Since all other main board components are the same, you can upgrade simply by snapping in a new daughterboard. Each of the 486-family daughterboards has a CPU upgrade socket to allow upgrading simply by adding a new processor chip.

The five faster DECpc systems all include 32-bit local bus video, standard 512K video RAM, an on-board S3 P86C924 GUI video accelerator, a 128K external write back RAM cache, 4MB RAM expandable to 64MB on the motherboard, and a 122MB IDE hard disk.

Even when you start to add options, system prices stay respectable. We looked at a mid-line DECpc 433dx LP system. Starting from a base price of $1,849, the machine included the better .28-mm dot pitch 72-Hz 1,024-by-768 resolution low emissions monitor ($450), 8MB system RAM ($200 for the 4MB upgrade), 256K RAM cache ($90 to upgrade from 128K), and 1MB video RAM (a $75 option to increase from 512K). The total list price for the system was $2,664.

One interesting point about pricing is that all of the DECpc prices include shipping, handling, and sales tax, none of which is usually included in competitors' pricing.

DOS 5.0 and Windows 3.1 are also part of the base configuration of all the DECpc LP systems. The combination of 8MB RAM, 256K cache, 1MB video RAM, the S3 chip, and local-bus video delivers very snappy Windows performance.

The DECpc LP systems are an attractive group. The pricing is in line with what you currently have to pay for systems from other big name vendors. With good expansion capabilities, flexible hardware upgrade strategies, and high performance components such as the local bus video, GUI accelerator, and better-than-normal RAM cache, the Digital systems hold their own as single-user performance platforms. □

Benchmark Tests: The DECpc 450d2 LP

We tested the clock-doubled 50-MHz DECpc 450d2 LP, one of six machines in Digital's new DECpc LP series, and found that its implementation of local-bus video yields outstanding results on our Graphics Winmark benchmark test.

We used PC Magazine Labs' Hardware Performance Tests, Release 6.0, to measure each PC's performance. The Graphics Winmark is the geometric mean of 12 Windows-based graphics tests from WINBENCH 2.5, weighted to reflect how frequently various functions are used.

Higher scores represent better performance.	Processor (operations per second)	Memory (kilobytes per second)	Disk (kilobytes per second)	Video (thousands of operations per second)	Graphics Winmark (megapixels per second)
DECpc 450d2 LP (486DX2/50)	506	5,406	193	2,182	12.98
50-MHz 486DX2 average	487	6,430	276	2,539	5.51
Dell System 486D/50 (486DX2/50)	450	5,525	241	4,272	1.58

FACT FILE

DECpc LP Series

Digital Equipment Corp., Desktop Direct, P.O. Box 4076, Woburn, MA 01888; 800-722-9332

List price: DECpc 333sx LP, $899; DECpc 340dx LP, $1,549; DECpc 425sx LP, $1,649; DECpc 433dx LP, $1,849; DECpc 450dx2 LP, $1,999; DECpc 466dx2 LP, $2,199; VGA monitor, $350; SVGA monitor, $450

In short: Digital's line of modular desktop PCs demonstrates the company's new commitment to quality construction, comprehensive service and support, and aggressive pricing

417 ON READER SERVICE CARD

■ Scanners

Logitech's New Hand Scanner Does 24-Bit Color

BY GREG PASTRICK

Logitech is in the enviable position of marketing the first 24-bit color hand scanner able to capture 16.8 million colors and 256 true gray scales at resolutions up to 400 dots per inch.

Packaged with an improved Windows-based color version of its FotoTouch image-editing software, the $699 ScanMan Color hand scanner gives you a cost-effective alternative to high-priced color desktop scanners. It's an efficient, versatile tool for capturing and roughly editing high-resolution, full-color images.

Installation simply requires inserting the 16-bit interface card into an available slot and attaching the scanner's cable to it. The scanner and software will work with Microsoft Windows 3.0 and a VGA graphics card with 8-bit color, but you really need Microsoft Windows 3.1 and a good 24-bit color video graphics card with fast VRAM to enjoy speedy processing of the scanner's full-color captures. We used the Diamond SpeedStar 24X on a Compaq Deskpro 386/25e for our evaluation, but more processing power and higher-end graphics adapters are a necessity for faster screen redraws when displaying full-color image captures at high resolution.

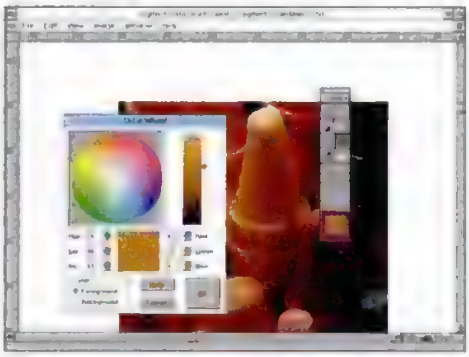
Though hand-operated, the scanner is smooth and steady, with a design that nearly defies producing a bad line art, gray-scale, or color image scan. The 3-inch rubber roller and two rear guides on the underside of the 6.3-inch unit keep its 4-inch scan window on a straight glide path over the image being scanned. A contrast wheel and DPI selector are on the back and side of the device, while the large 1-inch diameter scan button sits atop it. The ample dimensions of the ScanMan (1.8 by 4.9 inches at its highest and widest points) and the 78-inch cable make it easy to use for portrait and landscape scans.

Hardware and software work together in the ScanMan Color package to prevent loss of data on single and multiple passes of the white-light scanhead in either orientation. You get visual and audio alerts if you move the scanhead too quickly for accurate capture and manipulation of the image data. The scan screen for acquiring images gives you preview capabilities as you scan and allows adjustment of the scan width directly from the screen. For image capture beyond the ScanMan's 4-inch scan width, the package has excellent multiple-strip auto-stitching capabilities up to a maximum of four strips.

HANDHELD: *The ScanMan Color hand scanner.*

FOTOTOUCH SOFTWARE

Logitech has added total system calibration features (for screen, printer, and scanning device) to FotoTouch, along with a color wheel and context-sensitive help enhancements. You can use the color wheel feature, with controls for hue, saturation, and brightness, to add background and foreground color to line art or gray-scale images. You can also use it to match and introduce new color in the editing of full-color images.



RAINBOW: *ScanMan Color's FotoTouch software adds enhanced color-matching.*

FotoTouch gives you a set of basic but limited editing tools that in no way matches the full features of high-performance image editing packages. Basic painting tools include freehand, rectangles, polygons, and a set of brush selections. There are no circle, curve, or line tools, and the brush shapes can't be edited, though you can specify weights to the brush for opacity effects as well as lightening, sharpening, and smoothing.

The software comes with a basic set of global image effects, too. These include despeckling, smoothing, and sharpening. You can also reverse colors and gray scales for negative effects and globally equalize the tones of images.

FotoTouch flips, rotates, duplicates, deskews, and converts images from gray scale to color, and it includes standard features such as zoom (to eight levels), pasting, cropping, and freestyle scaling and sizing. All are easily launched either from key combinations, the interface command line, or the numerous boxes that pop up on-screen.

The ScanMan Color package supports .EPS write, JPEG, .PCX (8 and 4-bit color palettes), and TIFF (.LZW, packbits and CCITT) file formats and the full range of color depths from VGA to 16.8 million-color Super VGA resolutions.

ScanMan Color and Foto-Touch Color are compatible with OLE and TWAIN standards. Compliance with the TWAIN standard is important since it ensures a link to a large base of digital image-capture and processing hardware and software built around the multiple platform, multiple device API and protocol.

For effective, flexible 24-bit color image capture at a price that makes it a good alternative to a flatbed scanner, the ScanMan Color package is a welcome addition to the digital image-handling device arena. □

FACT FILE

Logitech ScanMan Color

Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717, 510-795-8500; fax, 510-792-8901.

List price: Including FotoTouch Color software, $699

Requires: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.0 or later, 16-bit expansion slot

In short: A versatile, easy-to-use hand scanner that's accompanied by high-quality image-editing software

430 ON READER SERVICE CARD

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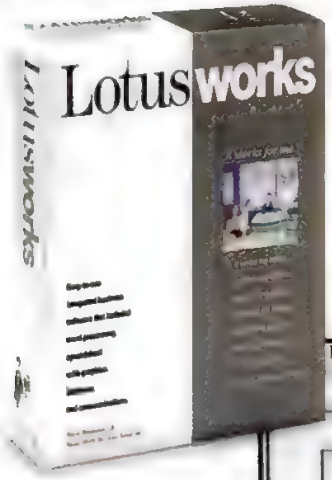

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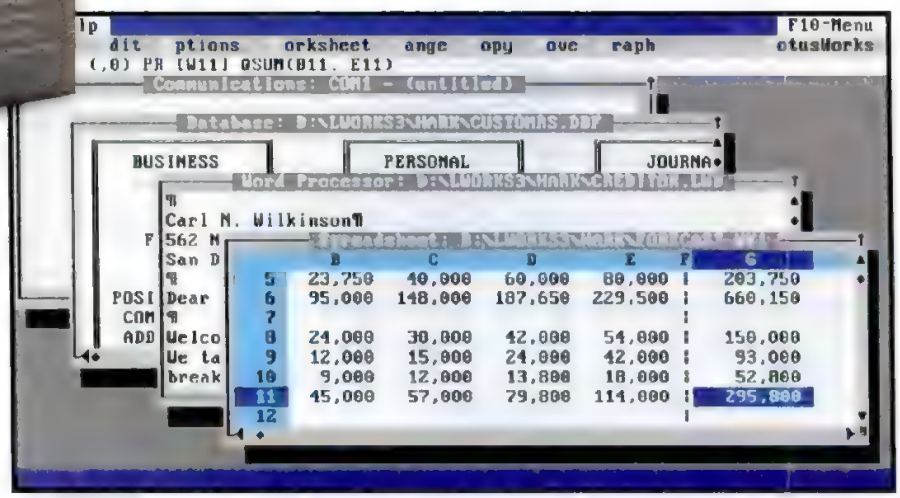

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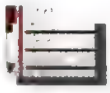

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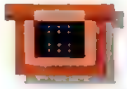

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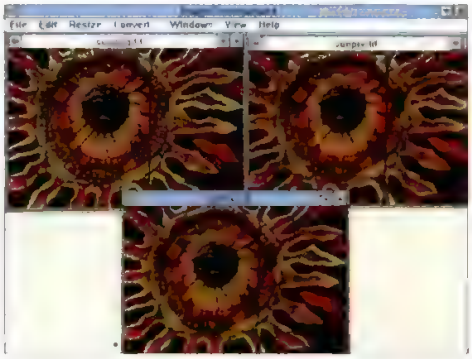
Data Compression

Images Incorporated: The Fractal Solution to Big Compression Problems

BY CAROL LEVIN

Unless you've got plenty of time and hard disk space to spare, using high-resolution, full-color images in desktop publishing and presentation work can be prohibitive. The files are just too big to manage, and the traditional data-compression techniques that work for text don't handle the complexity of color graphics very well. Images Incorporated, Version 2.0 ($299), is the first compression program that solves the problem with fractal mathematics.

This Windows-based program uses a compression scheme called Fractal Transform to crunch those gigantic graphics images by a 50:1 compression ratio and to enhance them in an entirely new way. Fractal compression achieves this impressive performance by identifying patterns, storing them as mathematical equations in a .FIF file (Fractal Image Format, defined by Iterated Systems), and then reconstructing the image by iterating the mathematical model. The program uses a software-based compression engine called POEM, which squeezes the accompanying 192MB of stunning 24-bit color photographs and illustrations into just 3MB of disk space.



TRANSFORM: *The image at left was reduced, then expanded using fractal enhancement (center) and pixel replication (right).*

Though fractal compression generates extremely small, resolution-independent files, it is a relatively new scheme compared to the JPEG (Joint Photographic Experts Group) standard, which uses the pixel-based Discrete Cosine Transform (DCT) method to drop bits of redundant information. By adding JPEG compression in Version 2.0, Iterated Systems opens its product to wider appeal.

FRACTALS IN PRACTICE

The big breakthrough is Fractal Transform Resolution Enhancement, a scaling technique that increases an image's resolution. From the Expand option, you specify an expansion factor (2, 4, 8, or 16) and method (quick or quality fractal expansion or pixel replication).

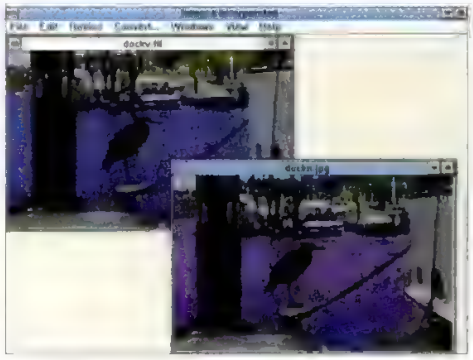
During expansion, the program adds detail by interpolating the value of pixels, not by simply duplicating them. The resulting images are sharper than pixel-replicated images. You can then save the enhanced image to the Clipboard, convert it to a supported form at (.BMP, .PCX, Raster, .TGA, or TIFF in several color depths) for further touch-up in an image-editing program, or use it in a desktop publishing or presentation application.

Fractal compression is an asymmetric method, which means that it decompresses images faster than it compresses them. JPEG is a symmetric method that compresses and decompresses at about the same rate. So for applications that require quick response time, such as multimedia presentations, fractal compression is best.

We compared the performance of the two compression methods on a Compaq Deskpro 386/25 with 8MB of RAM. It took almost 4 minutes to convert a 1.3MB TIFF file to a 228K .JPG file using JPEG lossless compression; it took twice as long to convert the same file to a 148K .FIF file. In the compression race, JPEG is faster, but Fractal Transform produces the smaller file (50:1 compared to 20:1 for JPEG on some files) and brings relief for transmitting huge graphics files. Fractals are speedier in decompression: It took 25 seconds to display the .FIF file; 2 minutes for the .JPG.

The primary shortcoming with fractal enhancement is that it's time consuming. It takes 10 minutes to double a 270K .PCX image, 51 minutes to expand it by four, and almost 15 hours to expand it by 16. This is partially solved by the new quick mode and batch mode, which can expand and convert images overnight. Still, the program should run time-consuming tasks in the background. Of course, the whole computation-intensive process is handled best by a compression board available from Iterated Systems.

Also, by sacrificing sharpness at higher resolutions, the fractal enhancement process is not ideal for high-end graphics work. The artifacts are not pixelated, but sharp edges tend to look blurred.



SHRINKING DATA: *Note the difference when the same file is shrunk to 6K in .FIF format (left) and JPEG format (right).*

The advantages of fractal compression, though, are unmatched. Images Incorporated puts fractal technology to practical use without forgoing users' needs for conventional JPEG compression, ample file support, and high-quality clip art. □

FACT FILE

Images Incorporated, Version 2.0
Iterated Systems, 5550-A Peachtree Pkwy., Norcross, GA 30092; 800-437-2285, 404-840-0310; fax, 404-840-0806

List price: $299.
Requires: 386-based PC, 4MB RAM, 3.5MB hard disk space, 4MB permanent swap file, Microsoft Windows 3.0 or later (8MB RAM, 10MB hard disk space, Windows-compatible SVGA adapter recommended)
In short: A Windows-based compression program that offers impressive fractal-based compression ratios as well as the JPEG standard, the unique Fractal Transform Resolution Enhancement tool and a stunning collection of clip art
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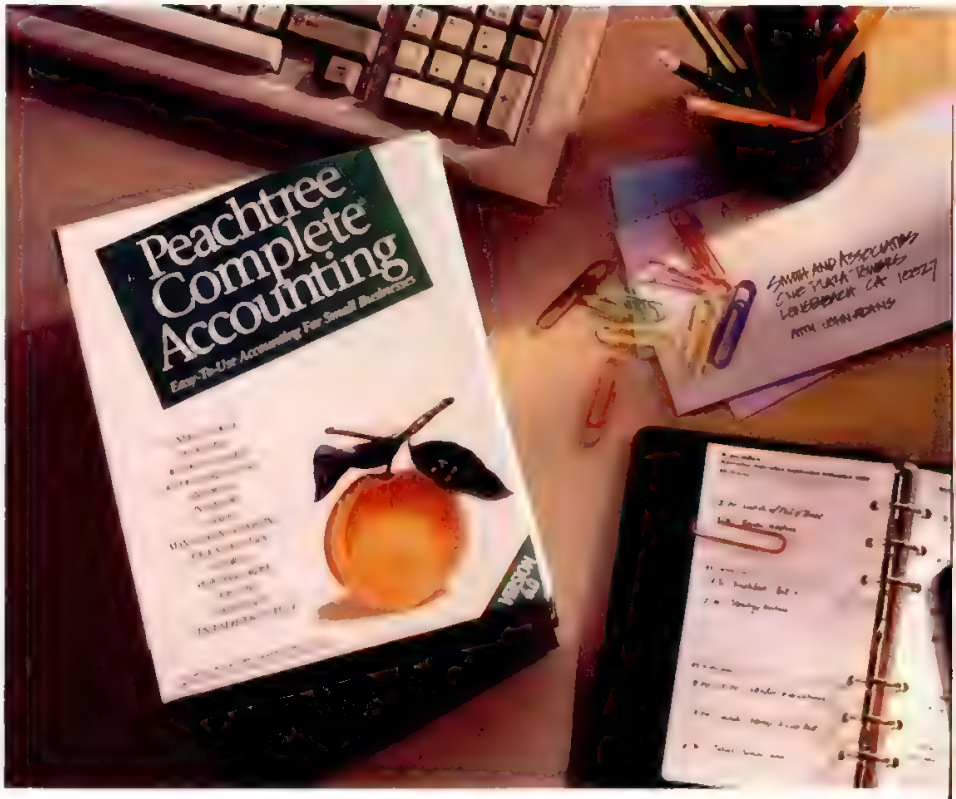

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CIRCLE 358 ON READER SERVICE CARD

■ Printers

$599 HP DeskJet Portable: Near-Laser-Quality Printing In Your Briefcase

BY ALFRED POOR

Portable computing always seems full of compromises, but when it comes to portable printing, you may be able to get all you want with Hewlett-Packard's $599 DeskJet Portable printer.

The DeskJet Portable owes its name and its lineage to the successful series of HP DeskJet desktop printers. Like its larger stable mates, the Portable prints at an eye-pleasing 300-dot-per-inch resolution. Even under magnification, the output rivals many laser printers for sharp, smooth text. The printer uses the same water-resistant ink as the DeskJet 500 (though it cannot use the DeskJet high-capacity ink cartridges), which produces excellent results with very little wicking, even on standard photocopy paper.

2-PPM SPEED

You don't give up speed to get this quality, either. HP rates the DeskJet Portable at the same 3-page-per-minute draft, 2-ppm final as the DeskJet 500 printer. In the PC Magazine Labs printer benchmark tests, it turned in speeds of 2.1 ppm for quality text and 1.6 gppm (graphics pages per minute) for graphics using the DeskJet driver.

Since the printer uses a variation of HP's PCL 3 printer language, it can also print LaserJet graphics, although it worked much more slowly, producing just 0.2 gppm. These speeds are nearly identical to the results for the desktop HP DeskJet 500.

The printer comes in a compact 2.5- by 12- by 5.8-inch package. The HP specifications rate it at just 4.4 pounds, but we found that it tips the scales closer to 5 full pounds. The difference is due to the fact that we included the ink cartridge and the battery. The AC adapter adds another 2 pounds.

FACT FILE

HP DeskJet Portable
Hewlett-Packard Co., Direct Marketing Organization, P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051-8059; 800-752-0900; fax, 208-344-4809

List price: $599, cut sheet-feeder, $99; extra battery, $49, rapid recharger, $99, carrying case, $99, 500-page capacity ink cartridge, $21 95

In short: The cleverly designed 8-pound DeskJet Portable delivers sharp output at about the same price as a desktop model

426 ON READER SERVICE CARD

The Portable has a rechargeable nickel cadmium battery. On a full charge, HP estimates that you can print up to 100 pages; the printer has a battery discharge cycle option, and recharging a fully drained battery takes about 6 hours. HP also offers a $99 external battery charger and extra battery packs for $49 each.

OPTIONAL SHEET-FEEDER

Another handy option is the cut sheet-feeder, which also lists for $99. Without this, you must feed pages into a slot by hand, one sheet at a time. The printer drops into the middle of the sheet-feeder, and you can then insert a stack of about 50 pages at a time. When set up for printing, the combined units make an attractive pair, balanced on a base and sticking out at 45-degree angles. The feeder worked well in our tests, and in spite of a tendency to feed the last two sheets in the stack at one time, it never jammed. When you want to travel with the DeskJet Portable, you can either pull out just the printer unit or fold all the combined parts into a flat 13- by 3.5- by 9.5-inch block that weighs just about 8 pounds.

The printer comes with a large complement of internal bitmapped fonts. You get Courier, CG Times, Univers, and Letter Gothic in a range of point sizes and pitches, in bold and italic. None of the fonts are scalable, but the printer comes with a Windows 3.1 driver that supports TrueType scalable fonts, and the printed results are excellent.

CARRY ME: *The HP DeskJet Portable travels well.*

EASY CONFIGURATION

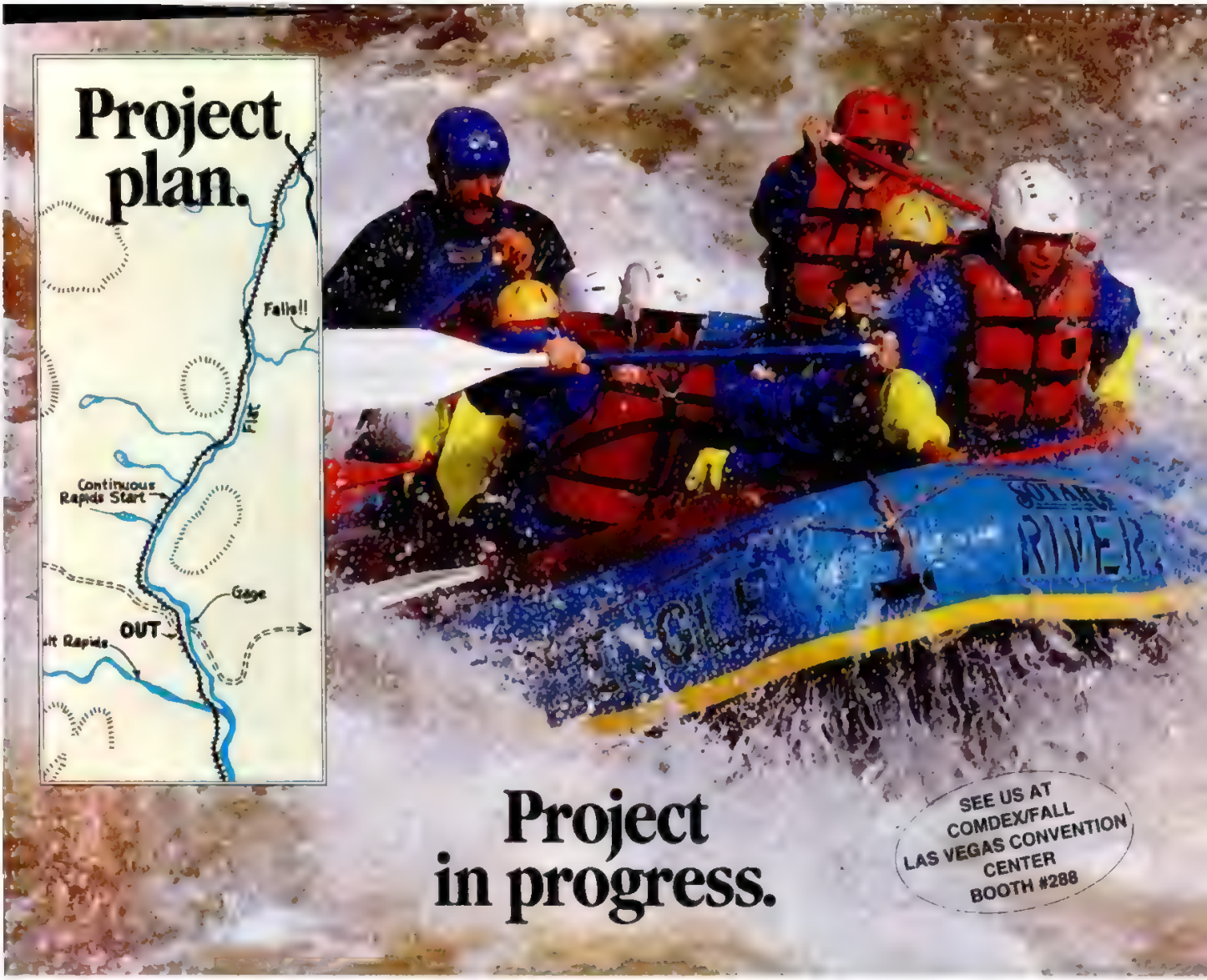
There are a number of configuration options for the printer, though the machine has no DIP switches. By pressing a front panel control button, you can put the printer in a menu mode. You then use buttons to select different settings. The same feature can also be used to get a reading on the remaining charge in the printer's battery.

The DeskJet Portable has only a single parallel port. It comes with a short, 3-foot long parallel cable that has a space-saving right-angle connector for the printer end. In contrast to the short length of the parallel cable, the AC power brick has a 6-foot cord for the AC outlet and another 6-foot cord to attach to the printer.

According to an HP representative, the design concept is that users probably work close to their computer but may have a longer distance to go for power. If you're using the printer with a desktop system, you can always use a longer parallel cable, since the printer uses standard connectors.

If there is any compromise with the DeskJet Portable, it's with the printer's paper handling. Even with the sheet-feeder, you can't fit many sheets at a time, as you can with desktop units. Nor is there any facility for printing on envelopes; however, HP does approve sheets of labels for use with the printer, so you can use those to put addresses on correspondence.

For about the same price as a desktop ink jet printer, you get the same print-speed and quality in a package that you can stuff in a briefcase and take on the road. Now Windows road warriors can get near-laser-print quality to match the power of their portable computers anywhere they travel. □



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■ Programming

Visual Basic for DOS: A New Way To Program

BY BARRY SIMON

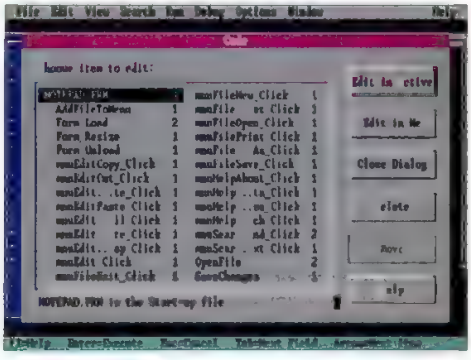
When it first appeared 18 months ago, Microsoft Visual Basic for Windows changed expectations of how easy it could be to program a user interface for Windows applications. With a visual metaphor for drawing the user interface and an event-driven programming model, it became possible to write a simple utility without first investing six months coming up to speed with Windows and object orientation.

Microsoft has done it again. Visual Basic for DOS, at a cost of $199 for the Standard Edition and $495 for the Professional Edition, is likely to have as profound an impact on what we expect from DOS compilers as VBWin had on the Windows world. VBDOS moves the visual-design/event-driven model to text-mode DOS applications. And Microsoft is aggressively marketing a competitive $99 to $199 upgrade to owners of any BASIC compiler or any programming language from Microsoft or Borland.

With the new interface tools in VBDOS, your text-mode applications can have something of a Windows look. Remarkably, the simple device of putting light borders on the top and left of a button and dark borders on the bottom and right gives those buttons a 3-D look.

That's just the start. You can add drag-and-drop capabilities with just a few mouse clicks, produce menus with an integrated menu editor, and easily add drop-down lists. There are even analogs to most of the Windows common dialogs to give you quick access to color choices, file open, and other standard dialog boxes.

This neat interface building does come at a cost. A simple "Hello, World" application produced with a standard BASIC print statement produced a 17K .EXE file compiled with VBDOS. Put that "Hello, World" into a window and the code size jumps to 115K.



POP-UP LIST: *The code module for a form (window) in Visual Basic for DOS.*

THE PROGRAMMING ENVIRONMENT

The programming environment is similar to that of Visual Basic for Windows. You can write pure Basic modules that can contain any Visual Basic code. You'd use such modules for any graphics mode programming you want to do, because the visual interface is only for text mode—one of VBDOS's glaring omissions. In addition, you can draw windows (called Forms) in form design mode.

There's a palette of controls, buttons, drop-down lists, and the like that you draw directly on the forms. Both the forms and controls have "properties." These include not only items such as color, which are standard in DOS program objects, but also items that pertain to such things as whether a form has a minimize button. When you select an item with the mouse, you can adjust its initial properties via drop-down lists in the programming environment. You can adjust properties during program runtime with code.

While generally a pleasure to use, the environment has some of the same awkward spots as VBWin. You can't see all the properties and their values at one time. You can't set a property of several controls at once. Setting the tab order is an arduous process.

But because of the limitations of DOS memory, there are some additional weak points. The code editor and forms designer are separate programs that get chained, so you can't easily check upon the names and initial values of properties while writing code, for example. Custom controls cannot be loaded from within the environment as you work; they must be loaded via the DOS command line when VBDOS is started.

DOS UPGRADE PATH

Microsoft has dominated the Basic landscape with QuickBASIC at the lower end and the Basic Professional Development System (PDS) at the higher end. While Microsoft is careful not to call VBDOS a new version of these products, all of them are largely compatible, and Microsoft has announced there won't be further upgrades of QuickBASIC and PDS, though they will still be for sale.

The most significant incompatibility of VBDOS is that near strings are no longer supported; only far strings are. This will not only require some rewriting but could hurt performance of programs with extensive string manipulation, since manipulation of near strings is typically almost twice as fast as far strings. Additionally, VBDOS has some new keywords, doesn't support the creation of OS/2 programs, and has dropped the chain command with overlays.

PROFESSIONAL EDITION

The Professional Edition has a number of extra components and features. The most important are integrated ISAM database support and MOVE overlays that will use EMS or XMS if you have it available.

The Professional Edition has toolkits to aid you in making help and setup modules for your program; com-

• *Continues on page 48*

FACT FILE

Microsoft Visual Basic for DOS, Version 1.0

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400

List price: Standard Edition, $199 (upgrade, $99), Professional Edition, $495 (upgrade, $199)

Requires: 640K RAM, 5MB hard disk space (Standard Edition), 11MB hard disk space (Professional Edition); DOS 3.0 or later

In short: This software brings event-driven programming to DOS with flair. You'll be able to add a Windows-style user interface to your text-mode DOS programs. In an otherwise mouth-watering product, the main disappointment is that some of the limitations of MS BASIC have not been addressed.

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FIRST LOOKS PLUS

To download sample Visual Basic apps from PC MagNet, type GO ZNT:DEMOS from any CompuServe prompt. From November 9 through November 13, you can go online to discuss Visual Basic for DOS with Barry Simon and Visual Basic product manager Steven Podradchik. Type GO ZNT:EXEC.

STOCKING STUFFER

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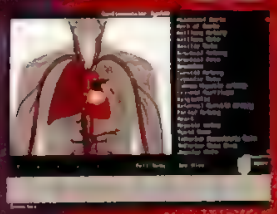

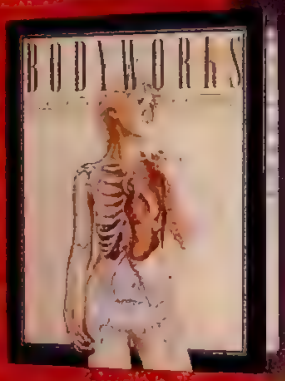

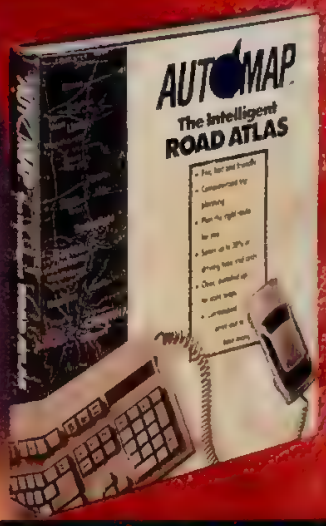

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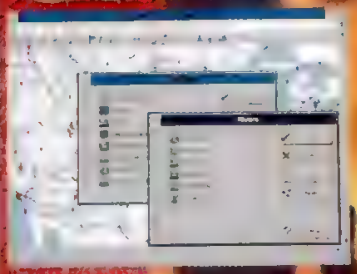

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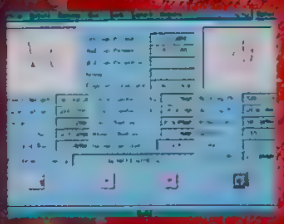

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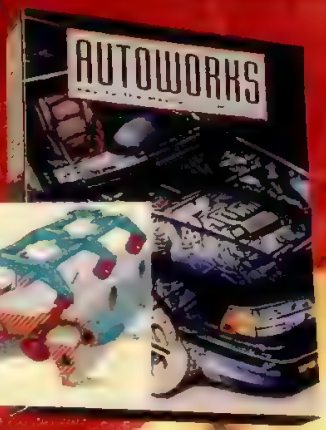

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Visual Basic

CONTINUED FROM PAGE 46

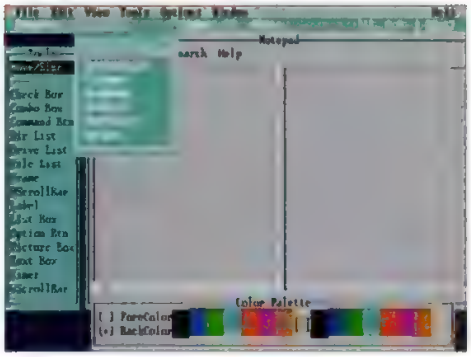
piler switches to turn on 386/486 code optimization; libraries of charting, matrix, and financial functions; a source code profiler; and the standalone Code View debugger module.

Also included are tools to make custom controls if you also have an assembler. You can expect an explosion of third-party custom controls like the one there was for VBWin, but your VBWin custom controls will not work directly in VBDOS.

THE LINK TO VBWIN

A translation utility is provided to go back and forth between the form files produced by VBDOS and VBWin. It's a kludgy approach that doesn't always work well. If you make DOS INT 21 calls in one case and Windows API calls in the other, the complete translation will be anything but effortless.

Maintaining separate DOS and Windows versions is made much more difficult by the continuing lack of conditional compilation in Microsoft BASIC products. There really is no way to avoid having to make the same code fix-ups by hand when you do the translation. It would be much better to have no need for translation at all.



FORMS: *The form design module has a floating list of controls.*

LANGUAGE CHANGES

One change in the language is cause for celebration: By adding a line, "option explicit," at the start of a module, you're forced to predeclare variables explicitly. No longer will you be burned by obscure bugs caused by misspelling a variable name. This option is offered on a module-by-module basis so you can continue to use old code without predeclared variables.

Other than that beneficial change and the fact that string constants have been moved out of the Dgroup, most of the news on the language front is less exciting. Microsoft hasn't addressed some of the limitations of its BASIC, which have given the language something of the reputation of a toy.

There are still no byte variables; there is no unsigned integer, no way to have a function return a user-defined or array type, no in-line assembly, no support of Super VGA– or 8514–specific graphics modes, no built-in way of getting the address of a procedure (needed for interrupt handlers), and no support for pointers. All these have been in Borland's Turbo Pascal and all the popular C development environments for years, and they have been requested by serious BASIC programmers for just as long.

But while Visual Basic for DOS has its share of disappointments, the overall impression it leaves is one of excitement and awe. It's the most innovative language product to come along since Visual Basic for Windows. Any BASIC programmer will want to get it right away, and anyone else interested in a quick route to simple DOS programs with sparkling interfaces will, too. □

Printer Utilities

Elesys Gives Your Printer PostScript in a Box

BY EDWARD MENDELSON

The Elesys Page Processing System gives almost any laser and dot matrix printer a double life as a PostScript printer. The system, which costs $899 to $1,299, is a box daisy-chained between your computer and your printer that processes PostScript files and uses your printer to output them to the page. Elesys's solution is faster than PostScript cartridges and simpler than boards that plug into your computer.

The box measures 2.25 by 9.75 by 10.5 inches (HWD) and works with any 300-dot-per-inch HP-compatible laser printer, plus DeskJets and Epson- or ProPrinter-compatible dot matrix printers.

The $1,299 model 20300 adds extra inputs: Two users can connect the box to parallel ports on their computers; the other two use slower serial ports. A $49 LaserLink accessory speeds printing even further by sending data from the box to the printer through a cable to the video I/O port on the LaserJet II or III, in addition to the parallel port. All models hold 4MB of RAM, upgradable to 16MB.

The advantages of the Elesys system over alternative PostScript add-ons for LaserJets are simplicity and speed. The disadvantages are unimpressive output quality and problems in the automatic switching between PostScript and LaserJet files.

Unlike PostScript cartridges, Elesys offers high-speed output. A three-page Word for Windows text file took 48 seconds to print with a 32-MHz Elesys box and 89 seconds with the HP PostScript Cartridge Plus. A WordPerfect file with two downloadable soft fonts took 30 seconds with the Elesys, compared with 65 seconds with the HP cartridge. A PageMaker graphics file needed 34 seconds, as opposed to 64 seconds.

THE ELESYS: *Between PC and printer.*

But unlike PostScript cartridges, the Elesys system can't use the resolution enhancement in the LaserJet III or other recent printers, so text and line art appear comparatively rough-edged and coarse.

Most annoying of all, the Elesys's automatic emulation switching doesn't always work, so you sometimes get raw PostScript code instead of text or graphics. Printing files from Microsoft's Windows PostScript driver works perfectly, but the Elesys system doesn't switch to PostScript mode to print output from Adobe's Post-Script Level 2 driver.

The Elesys gives your printer a new life as a high-speed PostScript model, but problems with emulation switching and output quality may make you consider slower or more complex alternatives.

• List price: *Elesys Page Processing System: 16 MHz, 1 user, $899; 32-MHz, 1 user, $1,099; 32-MHz, 4 users, $1,299.* Requires: *HP-compatible laser printer, DeskJet, or Epson- or ProPrinter-compatible dot matrix printer. Elesys Inc., 528 Weddell Dr., Sunnyvale, CA 94089; 800-637-0500, 408-747-0233; fax, 408-747-0131.*

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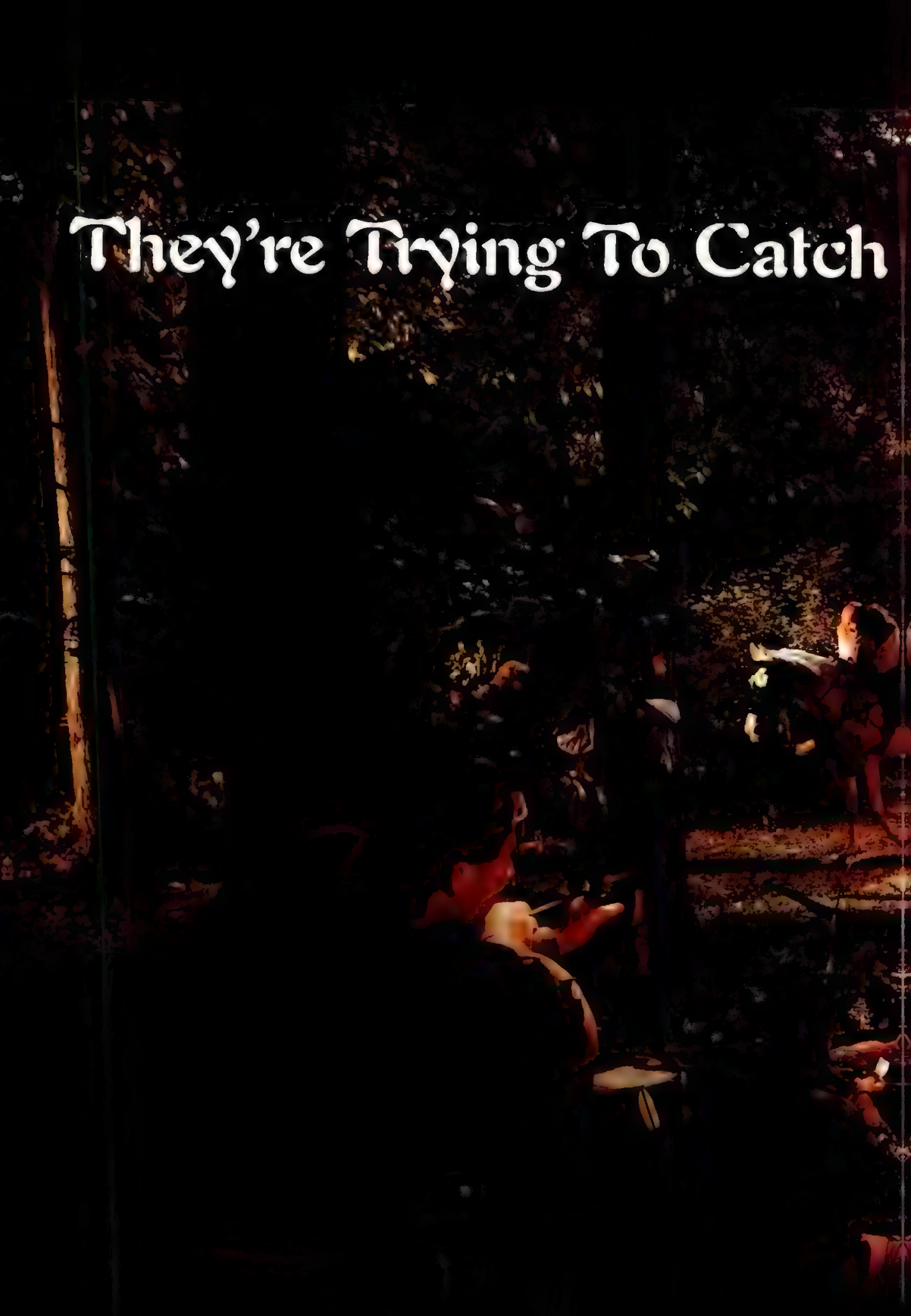

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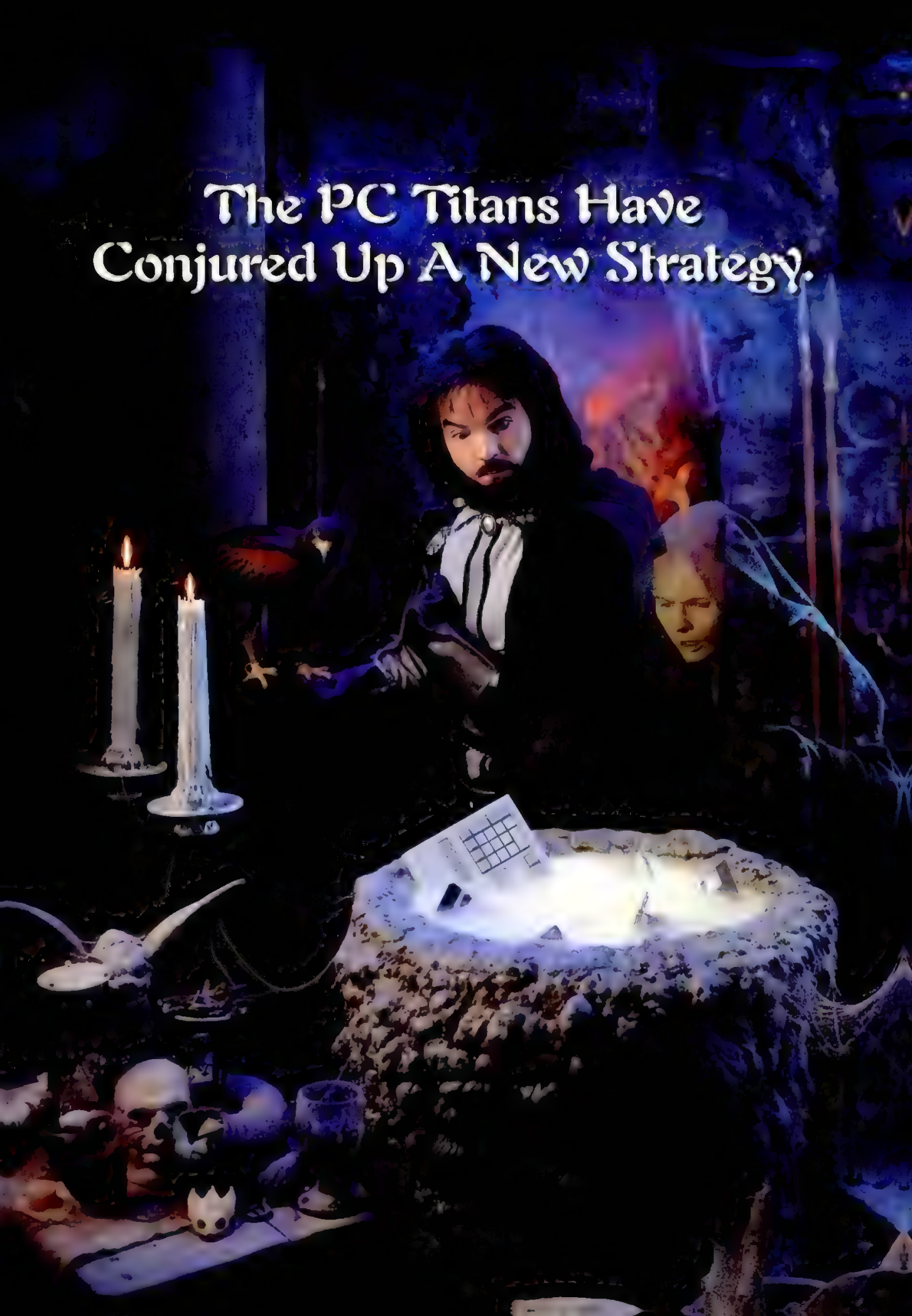
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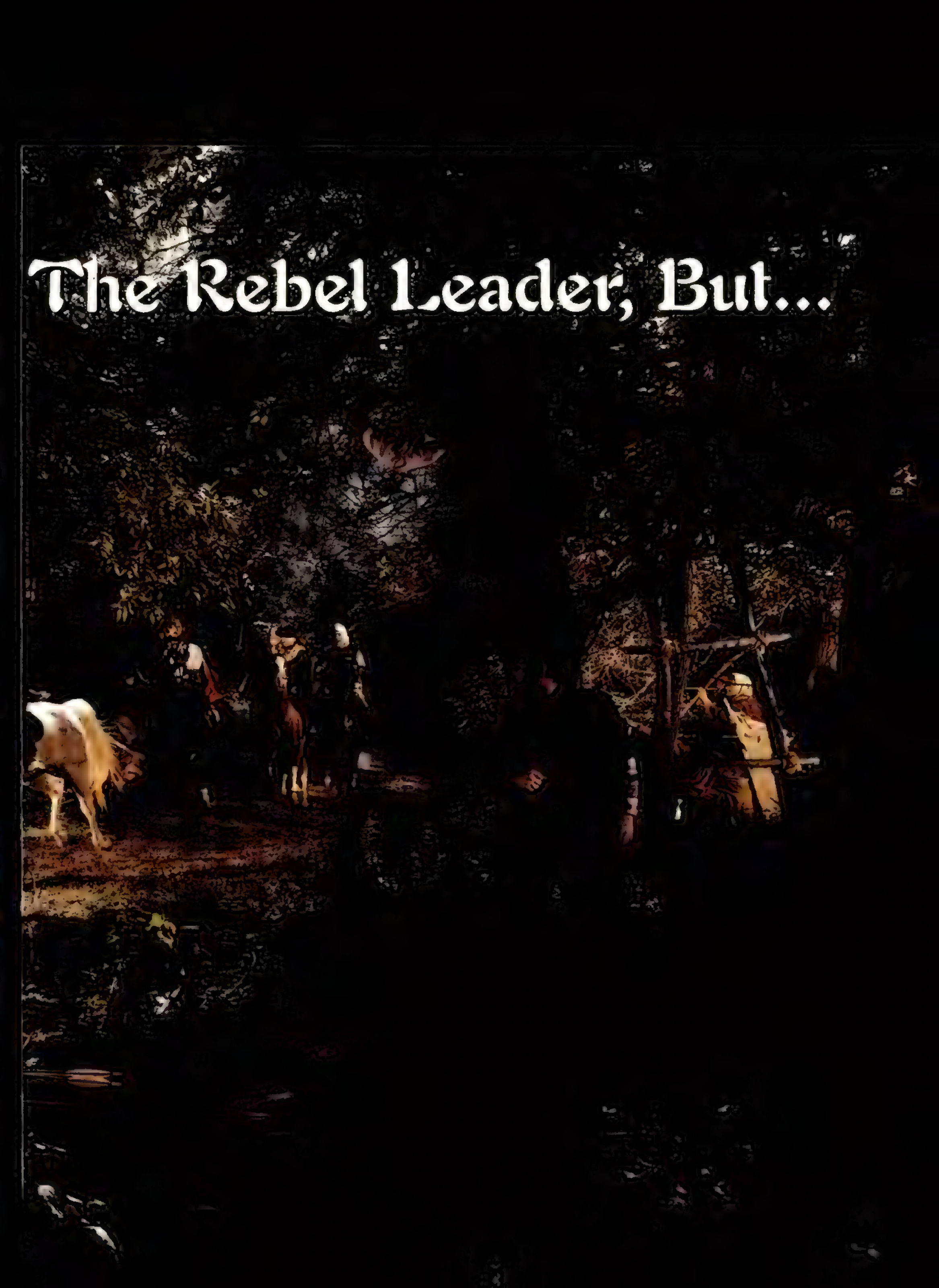
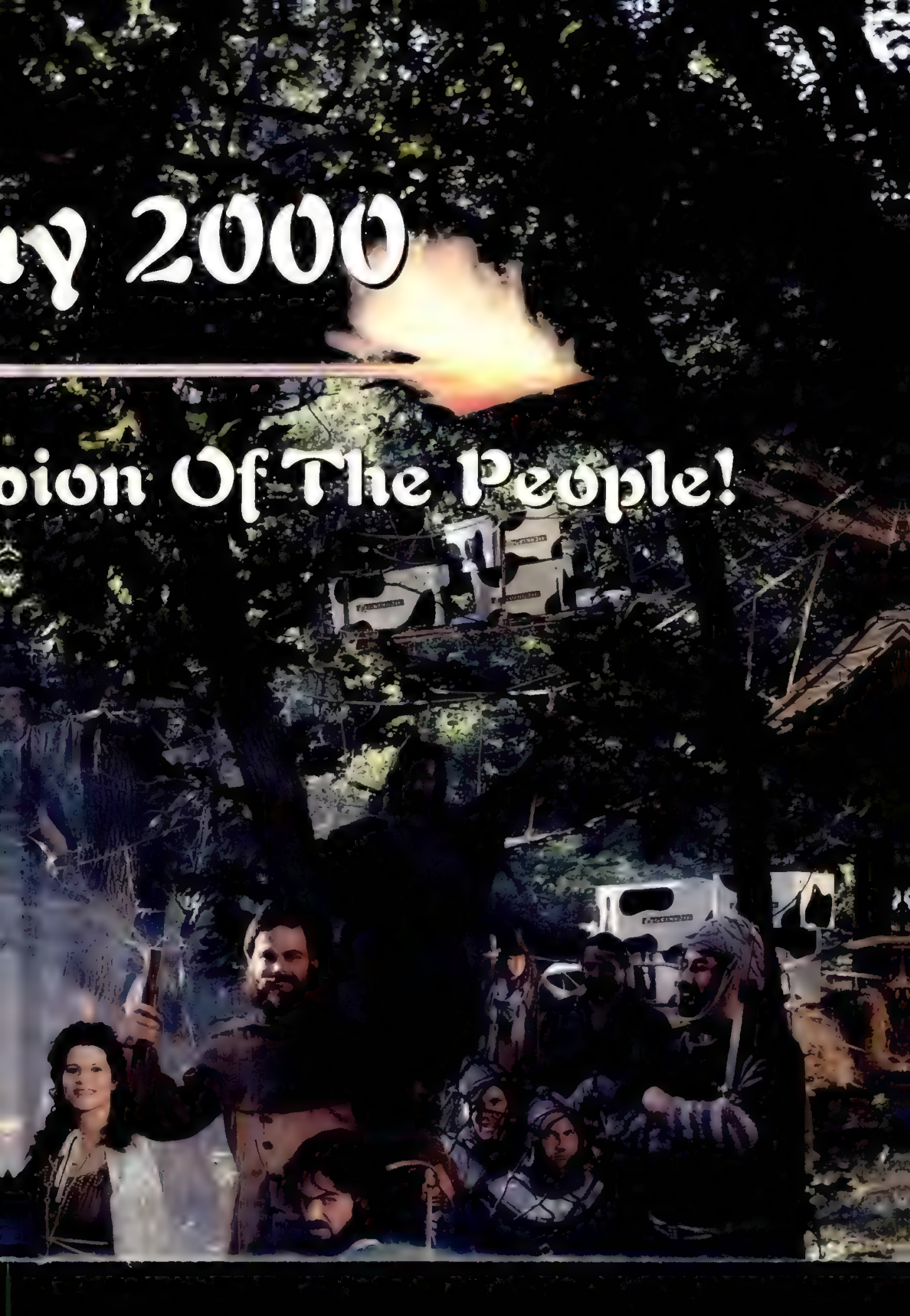

The Rebel Leader, But...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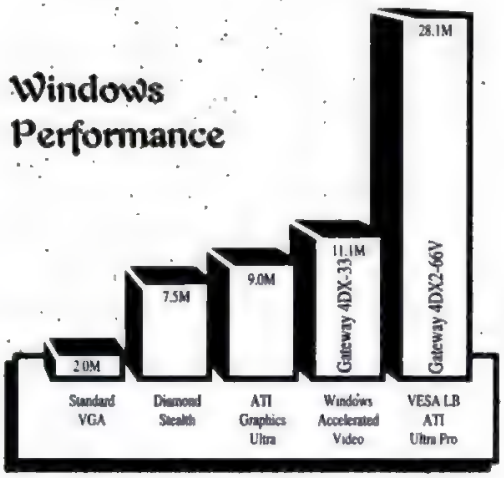

Based on Winmarks. Video performance varies with processor speed.

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- Size 5.9" x 9.75" x 1.4", 2.75 Lbs.
- 4.5-Hr. NiMH Battery & AC Pack
- 1 Parallel/1 Serial Port
- 78-Key Keyboard
- MS-DOS® 5.0, LapLink® XL, MS Works,™ Central Point® Desktop & Serial Download Cable
- Carrying Case

$1295

NOMAD 325SXL

- 25MHz 386SXL Processor
- 4MB RAM
- 3.5" Diskette Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 256K
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse™
- MS-DOS 5.0 and Windows™ 3.1
- MS Works for Windows™ 2.0

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NOMAD 420SXL

- 20MHz Intel® 486SXLP Processor
- 4MB RAM
- 3.5" Diskette Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

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NOMAD 425DXL

- 25MHz Intel 486DXLP Processor
- 4MB RAM
- 3.5" Diskette Drive
- 120MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

$2995

DESKTOP SYSTEMS

3SX-25

- 25MHz Intel 386SX Processor
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 80MB 17ms IDE Hard Drive
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey™ Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- MS Works for Windows 2.0

$1295

4SX-25

- 25MHz Intel 486SX Processor
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 120MB 15ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- MS Works for Windows 2.0

$1495

4SX-33

- 33MHz Intel 486SX Processor
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$1695

4DX-33

- 33MHz Intel 486DX Processor
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 200MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$1995

4DX-33V

- 33MHz Intel 486DX Processor
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 200MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 14" Color CrystalScan 1024NI
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus Extensions
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$2395

4DX2-50V

- 50MHz Intel 486DX2 Processor
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 200MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 14" Color CrystalScan 1024NI
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus Extensions
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$2595

4DX2-66V

- 66MHz Intel 486DX2 Processor
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 340MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus Extensions
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$2995

4DX2-66E

- 66MHz Intel 486DX2 Processor
- 8MB RAM, 128K Cache
- 5.25" & 3.5" Diskette Drives
- 500MB 11ms SCSI Hard Drive
- 32-Bit EISA SCSI Controller
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Tower Case
- 8 32-Bit EISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
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■ Multimedia

MultiSound Establishes the State of the Art in PC Audio

BY JOHN R. QUAIN

Just as purchasing a fine sports car means learning new skills to reap all the benefits, buying Turtle Beach's 16-bit MultiSound—unquestionably the finest sound card *PC Magazine* has tested to date—means learning new techniques to fully realize all of its features.

New users may find some of MultiSound's software functions esoteric and complex, but those who need to do corporate multimedia presentations, professional MIDI composition, or simply want the best sound available in a PC will appreciate this full-length 16-bit ISA card's flexibility and sonic quality.

Originally priced at $995, the MultiSound has been reduced to a more moderate $599. Even with dealer discounts, the MultiSound is still $150 to $200 more than some 16-bit sound cards now available. But the premium Turtle Beach asks you to pay is justified by MultiSound's outstanding sound reproduction, recording quality, and MIDI synthesis.

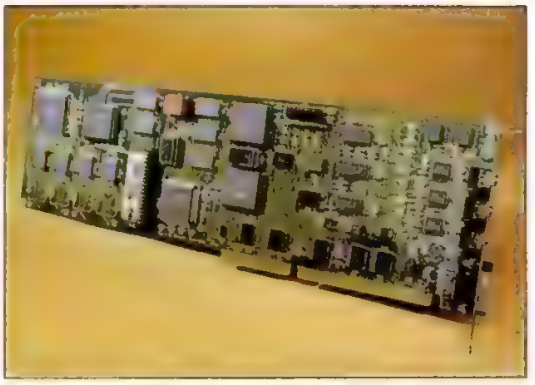
MultiSound employs separate digital-to-analog and analog-to-digital converters. Using sigma/delta or "one-bit" converters with 64-times oversampling, MultiSound is able to produce 18-bit audio output (which is filtered down to 16-bits) and record 16-bit stereo audio at up to 44.1 kHz.

The sound board has a rated frequency response of 0 to 20,000 Hz (+/-3dB) and can faithfully reproduce sounds and instruments with less than 0.005 percent total harmonic distortion. The volume delivered by MultiSound is considerably louder than any 4-watt rated sound card currently on the market.

To conduct MultiSound's audio channels, Turtle Beach uses a 20 MIPS Motorola 56001 DSP. The chip is responsible for offloading tasks usually relegated to the CPU, including the ability to play back and record sounds through the card simultaneously.

MIDI users will also appreciate Turtle Beach's unique synthesizer design. Unlike most PC sound boards, MultiSound does not use FM synthesis. In FM synthesis, a chip uses two or four operators or sine waves to recreate the sound of an instrument. The result is less than realistic, to say the least. So Turtle Beach uses 4MB of ROM to store 383 16-bit digital recordings of 126 instruments.

MIDI users will recognize the conductor for this section, an on-board Proteus/1 XR from E-mu. Typically available as a $1,295 rack-mounted external component, the Proteus/1 XR has been reduced to a few chips and is responsible for managing the instrument samples and MIDI playback. Novices will find its Windows interface difficult to use, but old hands will appreciate its compatibility with the original Proteus/1 XR.



SOUNDS GOOD: *The high-end MultiSound.*

INPUTS AND OUTPUTS

Physically, MultiSound has all the connections needed for a multimedia sound or a MIDI setup. In addition to a MIDI hookup, external minijacks include a stereo record input, auxiliary line input (for CD-ROM or other stereo component), and a stereo output.

Although there is no specific mike input, the record injack can be used for an external microphone. Sound recorded in this manner, however, may suffer from low volume. The card's lack of an amplified mike input preserves sonic integrity but means users who want to do voice annotation should make sure they purchase an amplified line-level microphone.

MultiSound

Turtle Beach Systems Inc., Cyber Center 1600 Pennsylvania Ave., Unit 33, York, PA 17404; 717-843-6916; fax, 717-854-8319

List price: $599

Requires: 386SX-based PC or better, 2MB RAM, 40MB hard disk, VGA adapter, Windows 3.0 with Multimedia Extensions or Windows 3.1, mouse, external speakers or headphones

In short: The MultiSound is a high-end 16-bit sound card for those who need top-quality audio. It will be the centerpiece of Turtle Beach's upcoming multimedia upgrade

422 ON READER SERVICE CARD

Installing the MultiSound card can be quick or tortuous, depending on what you have installed in your PC. The board's Windows setup allows you to select the card's port address, IRQ, and memory address, though the port address must be reset using a DIP switch on the card. MultiSound requires 32K of upper memory, but there are six memory addresses to choose from to solve any conflicts.

FIVE UTILITIES

Though Turtle Beach doesn't have any DOS applications to support MultiSound, the company does include five Windows 3.x utilities: a mixer, a diagnostics program, a software patch bay, a recording level program, and a Proteus/1 XR interface.

Also packaged with the MultiSound is Turtle Beach's Wave Lite for Windows, a subset of the company's Wave for Windows sound-editing software. It lets you do basic recording and editing of sound files and supports Windows 3.1's drag-and-drop feature. The full version of Wave, available as a $79 upgrade, adds special editing effects, including three-dimensional display of sound files, mixing of up to three files, reverse playback, an equalizer, and the ability to import and export files in various sound formats and sampling rates.

This fall, Turtle Beach will offer a $1,395 Multimedia PC Upgrade Kit that bundles MultiSound with a Texel dual-speed CD-ROM drive, a SCSI controller, Asymetrix's ToolBook, Wave for Windows, and a programming guide for the Proteus/1 XR.

Obviously, the MultiSound is a high-end component for those who don't want to compromise on sound quality. Users who just want to do a bit of voice annotation should look elsewhere. And if you plan on purchasing MultiSound, make sure you've got quality self-powered speakers or a stereo system to match. Twenty-dollar speakers will do MultiSound—and your ears—a severe disservice. □

Technology Preview

AT&T Paradyne Jams Fax/Modem Features onto PCMCIA Card

BY M. DAVID STONE

The KeepInTouch Card sounds like it should be part of some new long distance calling card program, particularly since it's credit-card size and comes from AT&T Paradyne. But AT&T Paradyne makes modems, and the KeepInTouch Card is just that: a modem, with fax.

Although AT&T won't sell you one, the card should be available through several vendors this fall. AT&T expects the price to be in the $450 to $500 range.

The card fits in the PCMCIA (Personal Computer Memory Card International Association) slot that's emerging as a new standard interface for notebook and palmtop computers. Any modem the size of a stack of four credit cards would be impressive, and the KeepInTouch Card is doubly so because it manages to shoehorn almost all the leading-edge standards for business communications into this small package.

TINY: *The AT&T Paradyne KeepInTouch Card.*

The modem offers V.32bis at 12,000 and 14,400 bps, V.42 error control with fallback to MNP 2 to 4, and both V.42bis and MNP 5 data compression. It also provides compatibility with the most widespread U.S. (Bell) and worldwide (CCITT) standards at 9,600, 2,400, 1,200, and 300 bps. For Group 3 faxing, the card is limited to 9,600 and 7,200 bps, but Class 1 compatibility means you have a wide choice of software that it should work with.

As you might expect, the modem supports the V.32bis capability to fall back to a lower speed if line conditions deteriorate. More notable is that it takes advantage of the optional V.32bis capability to fall forward if conditions improve.

Setting up the modem is simple. Once the card is initialized, the computer treats it as if it were connected to a serial port, so you can use it with standard communications software.

Actually using the card is much like using a small battery-operated external modem. You have to plug an external line access module into the modem, then plug a phone cable into the external module. Although this is less convenient than plugging a phone cable directly into a typical internal modem, it opens the possibility of having different line access modules.

AT&T also plans to provide a cellular phone access module in early 1993. Clearly, the KeepInTouch Card is not only state-of-the-art technology for a modem today, but a sign of things to come in both modems and PCMCIA cards.

• *AT&T Paradyne KeepInTouch Card, AT&T Paradyne, 8545 126th Ave. North, Largo, FL 34649.*

Circle 429 on reader service card

LAN Utilities

CheckList Inventories Software Locally or on LAN

BY STEVE RIGNEY

Applications software is a big investment, and keeping track of it can give a system administrator nightmares. TouchStone Software's CheckList is an easy-to-use software management and registration tracking system that keeps a detailed software inventory and license report so administrators can sleep soundly. It works on both standalone and networked PCs and is available in a DOS-only package for $99.95 and in a DOS and Windows package for $129.95.

CheckList identifies by title and location all programs on any disk drive. It has a database of over 5,000 program titles and the names, addresses, and phone numbers of over 3,000 software publishers. Updates are available on disk or via BBS for $29.95.

CheckList's three types of reports range from a detailed inventory report including filename, version, publisher information, location, size, and creation date to simple file and publisher reports. You can print or export the reports in comma-delimited ASCII or plain ASCII formats and then import them into your word processor or spreadsheet.

LICENSE AND REGISTRATION: *CheckList helps you keep track of your software licenses.*

Though CheckList may not be able to determine publisher information for a particular program, it is sometimes able to determine a program's function. For example, during a scan of programs in a NetWare file server, CheckList found PKZIP. It did not know the publisher, but it did determine that PKZIP is an archiving utility.

There's also a very handy letter-writing program that makes it easy to keep in contact with software vendors.

CheckList has a pull-down menu interface with three additional command-line utilities: RUN launches any executable program that was cataloged in previous inventories; INFO retrieves program and publisher information about any program on your hard disk; and XDIR works in much the same way as the DIR command in DOS, but it checks your inventory database to provide more extensive file information.

Use the program just once to help you register all your software, and the savings you get on inexpensive upgrades later will more than pay for CheckList itself.

• List price: *CheckList, Version 1.0, $99.95 (DOS); $129.95 (DOS and Windows).* Requires: *DOS version: 384K RAM, 1.5MB hard disk space, DOS 2.1 or later; Windows version: 512K RAM, 1MB hard disk space, Windows 3.0 or later. TouchStone Software Corp., 2130 Main St., #250, Huntington Beach, CA 92648; 800-531-0450, 714-969-7746; fax, 714-960-1886.*

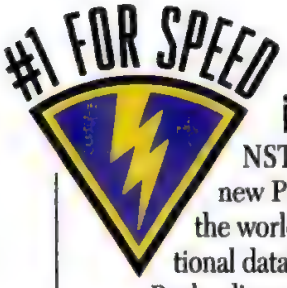
Circle 416 on reader service card

DEMAND PERFORMANCE

Introducing Paradox 4.0 for DOS

The most advanced database is now the fastest

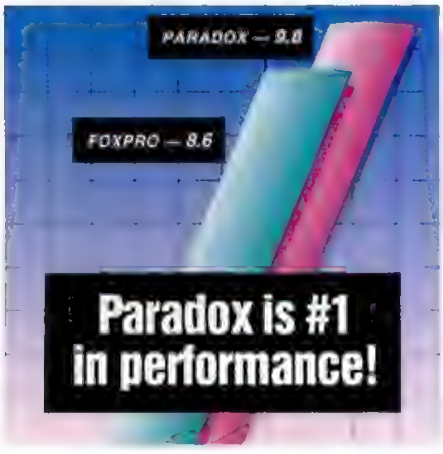
DEMAND



Paradox is fastest

NSTL results prove new Paradox® 4.0 is the world's fastest relational database! Thanks to Borland's new WarpSpeed™ performance, Paradox 4.0 sets the standard in performance for both network and standalone use. For you, this means faster answers to queries, faster memory access and faster multiuser applications.

In fact, Paradox 4.0 gives you unparalleled performance throughout all aspects of database management and application development. As NSTL put it, "Paradox is clearly the best all-around product evaluated." It beats FoxPro hands down.



Software Digest's *NSTL report rates Paradox highest of all databases tested in Overall Power and Performance.*

New Windows-like interface

Our new Windows-like interface makes using Paradox 4.0 more intuitive than any other database. Context-sensitive SpeedBar™ controls give you instant access to your frequently used commands and features. Movable, resizable windows, pull-down menus and mouse support make creating and editing your database simple. And new dialog boxes give you the choices you need in one place, saving time and effort.

The fastest way to get an answer

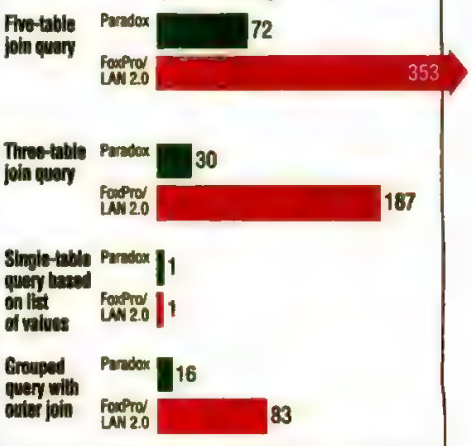
Paradox pioneered Query By Example (QBE), the easiest way to get answers from your database. Now, a built-in query optimizer enhances QBE, automatically finding the fastest path to the answers you're seeking. Plus, multi-table forms and reports make everything from data entry to presentations a snap—all without programming.

WarpSpeed

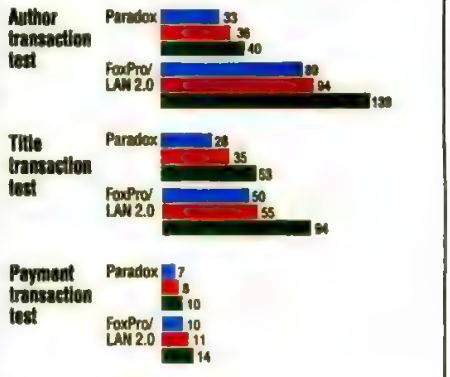
WarpSpeed stands for Wildly Accelerated Relational Performance. It reflects Borland's commitment to performance, and is also an integral part of our dBASE® and InterBase™ development programs.

NSTL tests confirm Paradox 4.0: Quicker than a Fox

Single-user performance tests
(in seconds)



Multiuser performance tests
(in seconds)



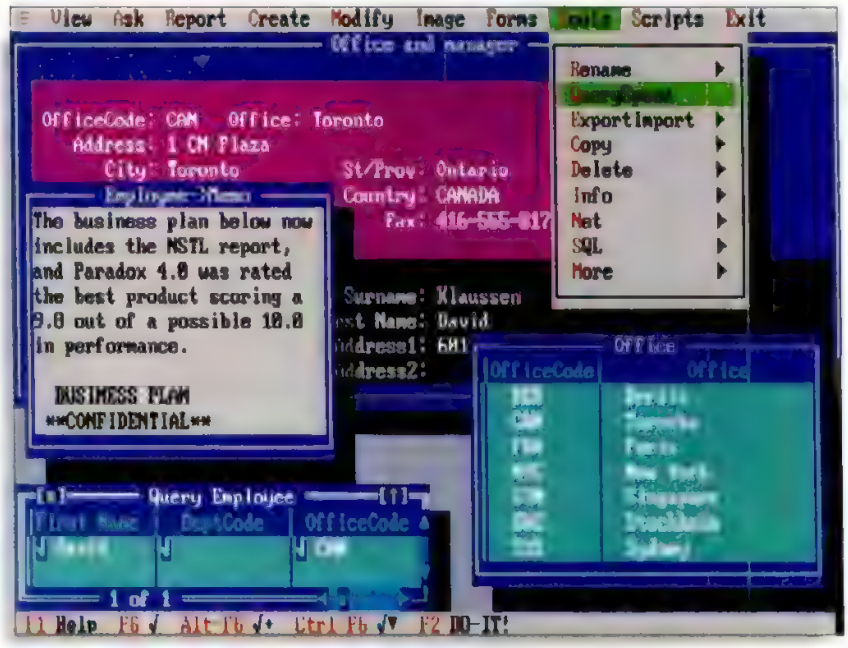
Multiuser Legend:
1 station **3 stations** **8 stations**

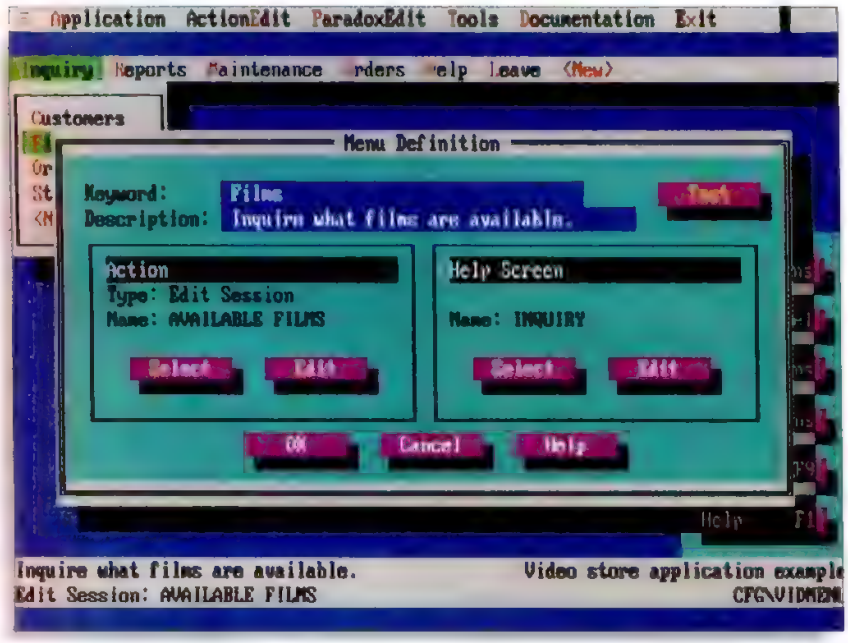
To test the speed of transaction performance, NSTL designed a database for book order entry. Each record contained an author, a title, an ISBN number, a price and inventory information. The database contained 25,000 books and 5,000 authors.

PARADOX

New memo fields

Paradox 4.0 gives you the power to manipulate data you couldn't manage with ordinary databases. With new variable length memo fields, you have the ability to effortlessly manage large amounts of text information throughout your applications. And you can store anything you want in the new binary field—word processor documents, sound, bitmapped graphics, multimedia data—and then manipulate it under program control. Each can hold up to 256Mb of data per field—up to 4 gigabytes per table! There's no easier way to manage large applications.





◄ *With the new Applications Workshop, you can build complete applications that include pull-down menus, mouse support, transparent multiuser edit sessions and more. Best of all, it's simple!*

Efficient memory management

Paradox 4.0 gives you the best way to manage memory. VROOMM™ with Turbo Drive™ provides more available memory and more efficient memory utilization. So Paradox 4.0 runs on any 286 PC or above. In addition, Paradox 4.0 can run as a DOS application under the Microsoft® Windows operating environment, thanks to complete DPMI support.

DEMAND

The most award-winning database

Since its introduction, Paradox has won more awards for technical excellence and customer satisfaction than *any* other database. Awards from every major computer magazine and periodical from around the world. In fact, in a recent survey by *Computer-World*, Information Systems professionals ranked Paradox as having the best technology, best documentation, best service and support and best price performance. All of which have made Paradox the favorite of users and developers alike.

Software Digest
PARADOX® SQL LINK
★★★
Rated # 1
Vol. 8, Number 2
February 1991

PC MAGAZINE EDITORS' CHOICE
May 28, 1991
Paradox, Version 3.5

PC WORLD BEST BUY
May 1991
Paradox 3.5

1992 BYTE READERS' CHOICE AWARD
March 1992
Paradox 3.5

Software Digest
PARADOX® 4.0
★★★
Rated # 1
Vol. 9, Number 2
May 1992

DBMS COMPUTERWORLD 1992 DOS-BASED
BEST TECHNOLOGY
BEST SERVICE/SUPPORT
BEST DOCUMENTATION
BEST PRICE/PERFORMANCE

Faster network performance

Paradox 4.0 is the fastest multiuser network PC database ever. And it's network-ready right out of the box. Multiple users can read, write and modify data simultaneously. You get all this, plus new automatic group lock security that allows multiple users to share data flexibly, providing dramatically increased performance. Just another reason Paradox 4.0 is the best investment for your business.

Transparent access to SQL data

With Paradox SQL Link (sold separately), you can seamlessly access remote SQL data. You can then work with this data using standard Paradox features such as Query By Example. Paradox does all the translation for you.

Paradox SQL Link completely shields you from the intricacies of PC and database server communications. When you specify an SQL table operation, Paradox SQL Link automatically selects the correct communications protocol, opens up

Paradox Developer's Corner

Powerful, procedural language

The Paradox Application Language (PAL™) lets you create sophisticated Paradox applications quickly. PAL procedures allow for private and global variables, array passing and variable scoping. Paradox 4.0 includes more than 90 new commands and functions.

Powerful UI controls

Easily construct your applications with a robust look and feel using the built-in UI controls: non-modal pull-down menus, dialog boxes (with push buttons, check boxes, radio buttons, pick lists, type-in lines and more), pop-up menus, mouse support and multiple overlapping windows.

Event-driven extensions

GetEvent() passes keyboard, mouse and/or system events into your procedures for dispatching. Use dynamic arrays to pass dynamically created data structures to procedures. This greatly increases the modularity and reusability of your code.

Leverage Paradox behavior

Build on Paradox's multiuser support for automatic locking, multi-table forms and referential integrity. Define special error-handling procedures to trap and process error conditions, giving you complete flexibility over users' interaction with your custom application.

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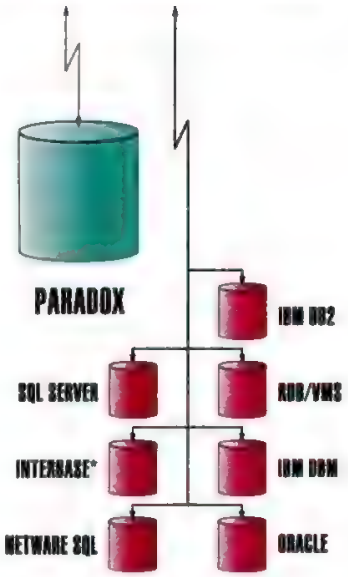
BORLAND



*Paradox SQL Link supports more industry-standard database servers than any other PC database available. (*And the InterBase SQL connection will be available soon.)*

a communication link, relays statements to the database server and presents the results of your query.

By using Paradox SQL Link, you can now enjoy the benefits of SQL databases without the difficulty of mastering the SQL programming language. In addition, Paradox SQL Link operations follow database server security restrictions.

Borland—the database leader

Borland is the acknowledged leader in PC relational databases. More users and developers trust their data to Borland products than any other company. And an integral part of that trust is Paradox.

Paradox 4.0's power to create and manage sophisticated applications, maintain data integrity, handle large quantities of data, perform complex database operations and connect to corporate data is critical to the success of a database management system today. No other PC database meets this challenge like Paradox 4.0—the most advanced database. Best of all, with Paradox 4.0's 60-day, money-back guarantee, you can order risk-free today. So demand the best. Demand Paradox!

To upgrade or order, see your dealer or call 1-800-331-6007, ext. 5856 today!

Canadian customers call 1-800-461-3327.

BORLAND

Software Craftsmanship

CIRCLE 220 ON READER SERVICE CARD

CD-ROMs

What City, Please? National Phone Books Come to CD-ROM Affordably

BY BARRY SIMON

Would you like to try to track down one of your old high school buddies? Do you need to know the names of all the sporting goods stores in Orange County?

CD-ROMs and phone directories are a natural match; in fact, some CD-ROM-based phone books have been available for five years but for amazingly high prices. Even six months ago you'd have paid more than $1,000, but two new disk-based directories now bring prices below $200.

Both DAK Industries' $150 PhoneDisc and ProCD's $179 ProPhone National Edition come with three CD ROMs covering business, Eastern residential, and Western residential numbers. An entry normally has a full name, address, ZIP code, and phone number.

DAK says that their two residential disks have 72 million names, while ProCD claims "about 50 million" names. We ran comparisons on several last names, and the ratio was always just about 2:1 in DAK's favor, so ProCD's estimate may be a little high.

Of course, the vital thing isn't the number of entries but their quality. We took new phone books from ten cities, picked five names from each at random, and ran comparisons with both disks. Of the 50 names, DAK had 19 and ProCD 16. By comparison, CompuServe's GO PHONEFILE database (with a $15-hour-surcharge and 75 million names) had 33 of the 50 names (but you can only search CompuServe's database on a state-by- state basis).

Part of the reason for the low hit rate is that roughly 20 percent of us move each year; however, the database sources also need to be improved. DAK was 0 for 5 in Denver, while ProCD was 3 for 5, but the opposite was true in Minneapolis. I've lived in one place for 11 years, but I'm not on DAK's list.

Both programs have lightning-fast searches on last names, scrolling instantly as you type in a name. Limiting to state, area code, or ZIP code takes longer, but both programs allow you to do it. DAK allows searching on a given street name; ProCD doesn't. Both DOS-based interfaces are usable, but ProCD's is more intuitive.

Both programs have a phone-dialer pop-up. PhoneDisc doesn't keep a configuration file, so you must tell it each time which comm port your modem uses.

One big difference between the products is that ProCD's license lets you use the data to compile a mailing list for your own use (but you are restricted from reselling the data), while DAK forbids such use.

Both these disks are so compelling that they'll justify the purchase of a CD-ROM drive, and if you already own a CD-ROM drive, they're tempting indeed.

- List Price: *PhoneDisc, $149.90 ($129.90 if you purchase or own a DAK CD-ROM drive).* Requires: *CD-ROM drive, DOS 3.1 or later. DAK Industries, 8200 Remmet Ave., Canoga Park, CA 91304; 800-325-0800, 818-888-8220; fax, 818-888-2837.*

Circle 420 on reader service card

- List Price: *ProPhone National Edition, $179 ($349 after 12/31/92).* Requires: *CD-ROM drive, DOS 3.1 or later. ProCD Inc., 8 Doaks Ln., Little Harbor, Marblehead, MA 01945; 617-631-9200; fax, 617-631-0810.*

Circle 421 on reader service card

Security

Firmloc: Simple, Effective Security for $249.95

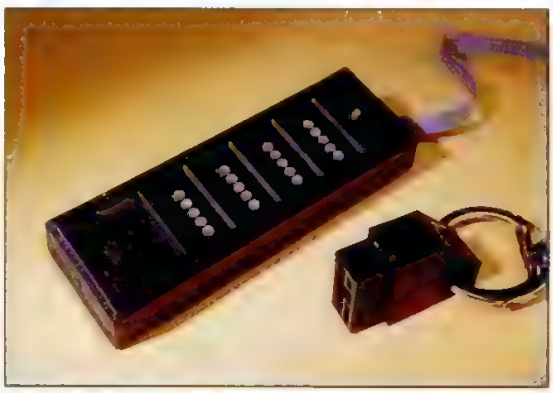
BY HENRY FERSKO-WEISS

Intelligent Security Systems' Firmloc provides nearly impenetrable security for your PC with no passwords or hotkeys. Using a combination of hardware and software, Firmloc locks your system with an electronic key. It's easy to install and provides several administration utilities. For $249.95, you'd be hard-pressed to find an easier or more effective security system.

Installing Firmloc involves three procedures but takes little time. First you have to install the key ring, a little box with four key connectors that gets plugged into your parallel port. Your printer can plug into the back of the key ring connector. Next you install the software, which lets you authorize one of the two keys you get as a master and the other as a backup.

The last step is the trickiest. You have to remove the connector from one of your floppy disk drives and attach the Firmloc access board. The other end of the access board has another connector so the cable can be reattached.

The access board comes at a right angle, for connection to 5.25-inch drives, or straight (with pin connectors), for use on a 3.5-inch drive. In most systems, one or the other will work fine, but in the Compaq Deskpro 386/25e used in PC Labs, neither board would work. The right-angle board didn't have enough room, and the 3.5-inch drive didn't have a pin connector. A spokesman for ISSI said a straight board with a card connector is now being manufactured to solve this problem.



KEEP OUT: *Firmloc puts a key on your PC.*

Once installed, Firmloc is extremely easy to use. When a key is in the key ring, you have access to your PC. When it isn't, access is denied. Each key has a unique internal code in its microprocessor, so no unauthorized key can be substituted. If you take the key out when the system is running, the screen goes blank, and your application is suspended. When the key is inserted again, you can resume activity exactly where you left off. Your system is protected while in operation as well as on boot-up.

The Firmloc utilities let you see who is authorized to use a PC, make or delete keys, and see the access logs. Each key ring can have up to 100 keys (extra keys cost $15 each). That makes it a good system for use on a network as well.

- List Price: *Firmloc, $249.95.* Requires: *7K RAM, DOS 3.0 or later. Intelligent Security Systems Inc., P.O. Box 1133, Addison, TX 75001; 800-237-4774, 214-315-1254; fax, 214-315-1597.*

Circle 424 on reader service card

■ Personal Information Managers

So Long, Agenda; Hello, Organizer: Lotus Creates a Winning PIM

BY GREGG KEIZER

Say farewell to Agenda. Lotus Organizer, a $149 PIM that uses an interface familiar to anyone who's ever opened a DayTimer or FiloFax, is a far friendlier information organizer than its ground-breaking but complex predecessor was.

Looking like a paper organizer, complete with cover, section tabs, and pages, Lotus Organizer packs its modules into a single window: calendar, to-do list, address book, notepad, planner, and anniversary reminder. Unlike more feature-laden Windows PIMs that throw up a blizzard of windows and make information integration difficult, Organizer stresses the basics to make sure you connect the day's details.

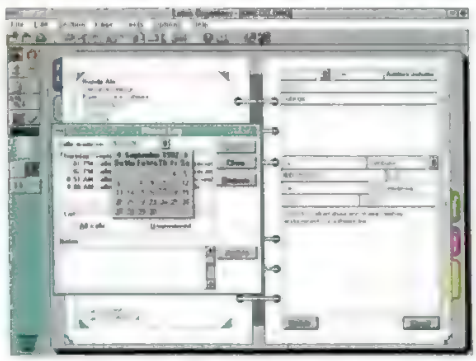
Navigation follows the paper metaphor. You move through sections and turn pages by clicking on tabs and dog-ears. Menu commands and keyboard shortcuts exist as alternatives. Customizing options let you change the order of sections, add new sections, and grab pieces of other Organizer files to include in yours.

Organizer's calendar displays yearly, two-week, weekly, and two-day views; schedules recurring appointments; includes an alarm with numerous tunes; and lets you move appointments to different days by dragging and dropping. Modifying an appointment's time, however, takes more work: You must either copy the appointment to a new time, then delete the old one, or delete the obsolete and create a new one.

It's impossible to schedule conflicting appointments, which can be a boon or a bane depending on your work habits. And since the calendar serves as a central repository for items from the to-do list and the long-range planner, you can use it as a convenient window on an entire day's activities.

The most distinguishing feature of Organizer's to-do list is its contrasting colors for overdue, present, and future tasks. You are limited to three priorities throughout the list.

Like most PIMs, Organizer assumes you'll spend most of your time with its address book. Though no match for a dedicated contact manager such as Act for Windows, Organizer's address book works well at storing and retrieving names, addresses, phone numbers, and a few other tidbits. You can change the book's view—packing as many as 18 contacts on a two-page spread—but you can't change the database form. Searches by field are possible, though no Boolean operations other than an implied AND are available.



NOTEBOOK: *Lotus Organizer can put as many as 18 contacts on a page.*

Organizer's auto-dialer is slick and lets you attach notes to log phone-call results.

INTRIGUING NOTEPAD

You'll find Organizer's notepad the most intriguing—and possibly the most confusing—part of the PIM. It's perfectly capable of storing text notes, of course, even acquiring and displaying documents and graphics from other files. But its power comes from Organizer's links, both internal and external. The latter are most useful and range from DDE connections (Organizer acts as a DDE client) to application and document launching. If you're of a mind to, you can turn Organizer into a replacement for the Program Manager.

Tying together the six modules is the job of the program's Anchor, a flexible but not automatic cross-referencing tool that links the database's bits and pieces. You can, for instance, connect an item in the to-do list—say, a phone call—to the appropriate contact. A click on a pop-up hierarchical menu and you zip from the to-do list to the address book, where you can access the auto-dialer. Overall integration is superb, though most of it must be handcrafted.

If you're using cc:Mail or Notes for your e-mail, Organizer notifies you when messages hit your box (the program checks every 5 minutes), and you can send mail from the PIM via the Clipboard. And though the program isn't meant to maintain group information, you can share sections of your PIM with others over a network, or even create a central calendar or address book that everyone copies to and includes in their personal Organizer files.

Organizer uses the now ubiquitous button bar (Lotus calls them SmartIcons) to speed tasks and launch other Lotus applications. Not only is the documentation clear and the context-sensitive on-line help excellent, but a click of the right mouse button on any icon tool displays a help balloon. The program also imports ASCII and dBASE files, so changing PIMs won't be too much of a problem. Organizer easily imported a dBASE file of nearly 900 records, and it has a mapping tool to match old and new fields.

This program is no substitute for a robust contact manager because it won't log calls to contacts, let you attach multiple note files to individuals, perform mail-merge without heading to an external word processor, or let you customize the address database.

As a replacement for a paper organizer, however, this Windows PIM is highly recommended. It's easy to learn, easy to use, and maintains the kind of connections that are impossible to duplicate on paper. As an affordable, graphical personal information manager for the masses, Organizer comes closest to turning your PC into a flexible DayTimer-on-disk. □

FACT FILE

Lotus Organizer, Version 1.0

Lotus Development Corp., 55 Cambridge Parkway, Cambridge, MA 02142; 800-343-5414, 617-577-8500.

List price: $149, upgrade for Agenda 2.0 users, $69

Requires: 2MB RAM, 3MB hard disk drive space, Windows 3.0 or later

In short: Lotus stresses a familiar notebook-like interface and superb integration in its Organizer, an affordable Windows personal information manager

419 ON READER SERVICE CARD

LAN Backup

NetWorker Backs Up LANs Or Mixed Environments

BY M. KEITH THOMPSON

Legato Systems, a vendor of Unix-based network backup software, has made a move into the NetWare market with NetWorker, a program that provides backup and archive services for NetWare file servers with all types of clients, including Macintosh, OS/2, and Unix. At $750 for a ten-user version, NetWorker is a good value.

Since NetWorker complies with NetWare's SMS (Storage Management Services), administrators can back up all of their data, including files using multiple name spaces. For example, a server with HPFS, MAC, and NFS name spaces installed and serving OS/2, Macintosh, and Unix clients can be backed up onto one tape. NetWorker stores all of the information related to the files, including access rights and extended file attributes. Additionally, NetWorker backs up vital NetWare information such as the bindery and trustee assignments.

COMPLETE SOLUTION

NetWorker is a complete backup solution. Some of the more advanced features include password protection, data spanning across tapes, unattended backups, and control of automated tape jukeboxes.

Using NetWorker is simple. The NETWORKR NLM runs on the NetWare server and advertises its services to other computers on the network. Backups can be started from a client PC or directly from the NetWare console. The documentation includes detailed operating instructions along with a good explanation of backup strategies.

NetWorker recovers files rather quickly. The NETWORKR program uses pull-down menus to display volumes, directories, and files, either current or from any time in the past. Recovering files is as easy as marking the files you'd like to recover. NetWorker does the rest. It even shows you multiple versions of a directory or file that were backed up over time and lets you select the ones you want to recover.

MORE THAN JUST BACKUP

In addition to sophisticated backup functions, NetWorker operates as an archiving tool. Options in NETWORKR let administrators move old data off the server to tapes.

NetWorker can be especially useful for organizations with both Unix and NetWare servers. NetWorker backs up data from Unix computers onto the tape drive on the NetWare server. This flexibility allows network administrators to have just one point of contact for all network backups.

NetWorker is a robust and well-designed backup system, and by complying with NetWare's SMS, NetWorker works well with multiple name spaces and promises to keep up with future versions of NetWare.

• List price: *NetWorker, 10 users, $750; 100 users, $2,500; 250 users, $4,000.* Requires: *NetWare 3.11, 4MB RAM, ASPI-compatible SCSI controller, tape drive. Legato Systems Inc., 260 Sheridan Ave., Palo Alto, CA 94306; 415-329-7880; fax, 415-329-8898.*

Circle 428 on reader service card

PIMs

Quick and Easy Info Select Notetaker Comes to Windows

BY EARLE ROBINSON

Fans of Info Select, Micro Logic Corp.'s low-overhead PIM, will be delighted to see the new Info Select for Windows. It maintains all the features of the DOS version, is even easier to use, and has the same price: $149.

Info Select is a combination Post-it–type notetaker and full-text database. As a quick notetaker, Info Select lets you create up to 64,000 notes in individual files called stacks. These notes, computerized equivalents of your Rolodex and all the little jottings scattered across your desk, can be time-stamped, color coded, underlined, or in boldface. Any note that's a reminder to do something can be retrieved with the tickler hotkey.

The best part, of course, is that you can search through your notes in several ways. As you fill Info Select with sets of telephone numbers, to-do lists, letters, fax cover sheets, or random thoughts, the full-text database comes into play. Finding information that meets given criteria is very quick.

You can import data from the Windows Clipboard or any other ASCII text file, and you can export notes to a text file or move them to another Info Select stack. A LAN version of Info Select is available, too.

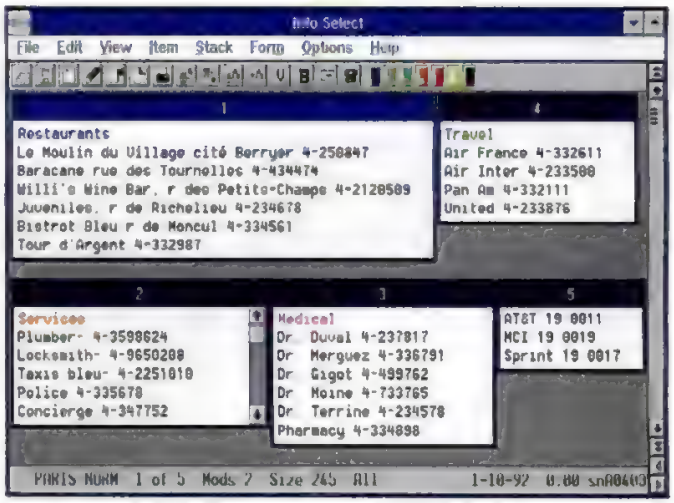
The program has a slick button bar. Move the mouse pointer over each of the 22 buttons and a brief explanation of its meaning is shown, as well as the alternate keystrokes to invoke its function. Keyboard navigation is as easy as it is in the DOS version. The same quaint key combinations are still there, with the option of disabling them. Newcomers may well wish to do so.

Weaknesses? Yes, there are a few. To continue using the DOS version of Info Select, you must maintain duplicates of all the stacks, and it's impossible to run both versions from the same directory. The tutorial only provides a bare minimum of assistance in learning to use this wonderful program.

However, Info Select offers the most convenient method of organizing (or *not* organizing) your notes, data, telephone numbers, recipes, or whatever else you can think of. It works the way you do—neatly, messily, or with a bunch of notes scattered around. There's no other application, for Windows or for DOS, that can do what Info Select can do so well and with such ease.

• List price: *Info Select for Windows, Version 1.0, $149.* Requires: *2MB RAM, Windows 3.0 or later. Micro Logic Corp., P.O. Box 70, Hackensack, NJ 07602; 800-342-5930, 201-342-6518; fax, 201-342-0370.*

Circle 425 on reader service card



QUICK NOTES: *You can jot down anything in Info Select.*

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Emerson Andrew Torgan

IMPROVED

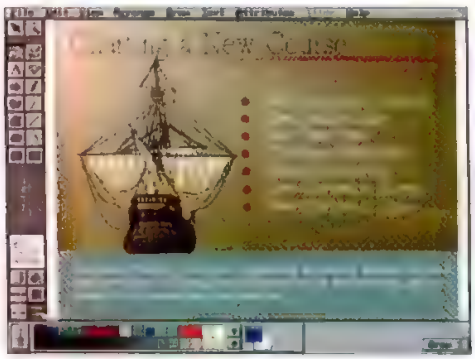
DrawPerfect Update Arrives as WordPerfect Presentations

The name isn't the only thing new here. **WordPerfect**'s presentation graphics package, formerly called DrawPerfect, is now WordPerfect Presentations. It includes a host of new features and enhancements, including sound support for MIDI (it has over 100 MIDI sound clips) and digital audio files, the ability to generate speaker's notes, a new paint module for editing color bitmaps, a tool for converting bitmaps into vector graphics, and new text editing and charting features. Also new to the package is the interface, which features a customizable button bar and pull-down menus. A Windows version, which WordPerfect plans to release in the near future, will have a similar interface.

Presentations 2.0 has an outliner, a slide sorter, and a collection of Master Gallery templates, as well as a chalkboard tool for annotating on-screen presentations. An integrated charting tool supports a wide variety of 3-D chart types, including bar, surface, high-low, pie, organizational, and bullet. Improvements to the graphics capabilities include enhanced color support (more than 16 million colors), a ruler, and gradients. The new version also provides a host of new tools for drawing regular polygons, rounded rectangles, and smart arrows, as well as blending tools. WordPerfect plans to offer multi-platform licensing, letting users who purchase the DOS version migrate to the Windows version for a low fee.

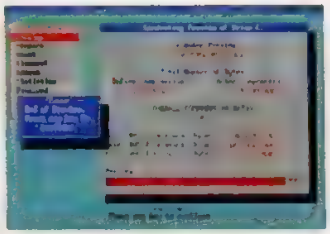
•List price: *WordPerfect Presentations, Version 2.0, $495. WordPerfect Corp., 1555 N. Technology Way, Orem, UT 84057; 800-451-5151, 801-225-5000; fax, 801-228-5077.*

Circle 402 on reader service card



The new look of WordPerfect Presentations 2.0.

HOT PROSPECT



Addstor Answers the Call for Windows File Compression

Addstor has revamped its popular data compression software package, SuperStor, Version 2.0, and delivered SuperStor PRO for DOS and Windows, which features Windows utilities and JPEG image compression. It incorporates an enhanced version of the lossless compression technology found in SuperStor 2.0, a technology that effectively doubles disk capacity by compressing data. The program is transparent to the user and applications, compressing data automatically as it is stored and decompressing it when it is retrieved. According to Addstor, compression and decompression occur in real time at the record level, eliminating the need to compress or decompress an entire file before data can be retrieved or written.

SuperStor PRO's JPEG image compression and expansion utility is licensed from Optibase and can compress 8-, 16-, and 24-bit color or gray-scale images at an average ratio of 20-to-1 with no loss of image quality. The program's Windows utilities provide access to functions such as a disk tune-up analyzer, disk information display, file and disk compression statistics, disk mount/dismount, and floppy disk preparation. It also offers the company's Universal Data Exchange (UDE) to let users read compressed floppy disks on any PC.

•List price: *SuperStor PRO, $149.95. Addstor Inc., 3905 Bohannon Dr., Menlo Park, CA 94025; 800-732-3133, 415-688-0470; fax, 415-688-0466.*

Circle 401 on reader service card

NEW

Extended Systems Unveils Line Of HP LaserJet 4 Accessories

Anticipating the success of Hewlett-Packard's HP LaserJet 4, **Extended Systems** has unveiled 12 new accessories designed for the printer, ranging from network interface cards and printer-sharing devices to plain-paper fax and fax server products. ExtendTalk allows Macintoshes on LocalTalk and EtherTalk networks and PCs on Novell Ethernet networks to share the same HP LaserJet 4 printer. The unit's 10BASE-T and 10BASE2 Ethernet ports simultaneously support Apple's EtherTalk, Novell's NetWare 286 and 386, and NetWare Lite operating systems. The $745 ExtendTalk ESI-2891A provides common printer connections for both Macintosh networks and PCs on Novell networks by supporting LocalTalk and Ethernet interfaces simultaneously. The $695 ExtendNet ESI-2886A provides direct connectivity for ARCnet users to HP LaserJet printers. The $395 TruePort ESI-1676A provides Macintoshes with access to the TrueType font rasterizer and 600-dot-per-inch print resolution of the HP LaserJet 4.

The $695 FaxConnection MFP lets you use the HP LaserJet 4 to print and receive faxes on plain paper, and lets you send and receive faxes from your PC as well. You can also connect an existing fax machine to the unit and use it as a scanner and copier. When the Fax-Connection MFP is used with the company's $595 Pocket Fax Server, it can be used on Novell's NetWare 286 or 386 networks. The Pocket Fax Server provides both fax server and print server capabilities.

Six printer-sharing products, five of which are part of the ShareSpool XL family, range in price from $495 to $1,395 and provide between four and eight PC connections and a variety of memory options. Finally, in mixed PCL and PostScript environments, Extended Systems' $1,995 Font Commander ESI-2640A stores fonts in 2MB of flash memory and downloads them to the LaserJet 4 on an as-needed basis. Fonts and macros are also restored from the Font Commander when the printer has been turned off.

•List price: *ExtendTalk ESI-2891A, $745; ExtendNet ESI-2886A, $695; TruePort ESI-1676A, $395; FaxConnection MFP, $695; Pocket Fax Server, $595; ShareSpool and ShareSpool XL, $495 to $1,395 (depending on memory and*

Photography by Thom O'Connor

Borland's

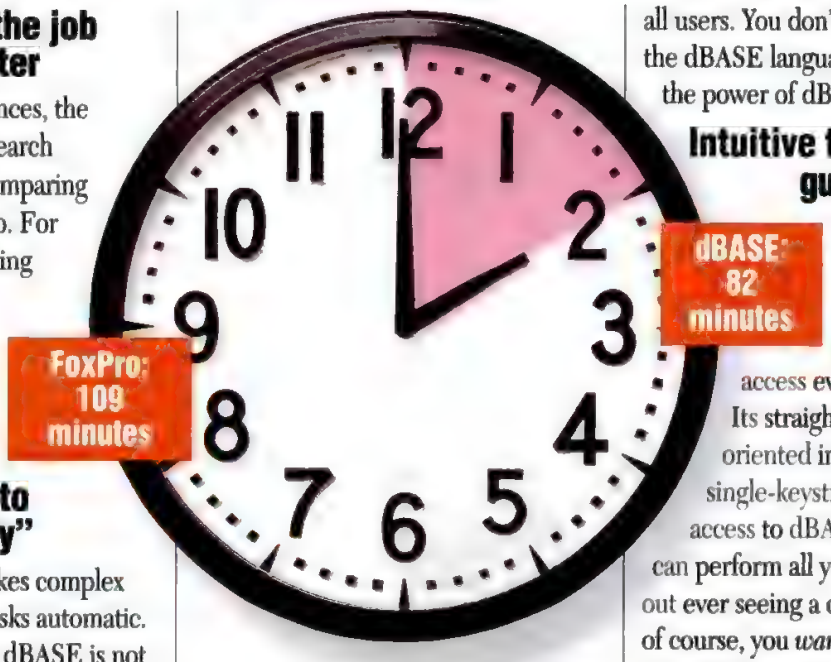
Get an extra 2 hours out

dBASE gets the job done faster

Recently, Usability Sciences, the leading productivity research firm, conducted tests comparing dBASE IV® with FoxPro. For everyday tasks like creating reports, browsing, linking, and using linked data, dBASE® users got their work done 25 percent faster.

The secret to "user-ability"

The Control Center makes complex tasks easy, and simple tasks automatic. Unlike the competition, dBASE is not merely a developer's tool. For those who *are* developing custom applications, the dBASE language sets the standard for power and productivity. But it's the dBASE Control Center that makes dBASE a favorite among all users. You don't have to learn the dBASE language before putting the power of dBASE to work for you.



dBASE takes less time to get the job done. *In independent tests using both dBASE and FoxPro, users got their work done 25 percent faster with dBASE. That's like getting an additional two hours of work done every business day. Now that's productivity!*

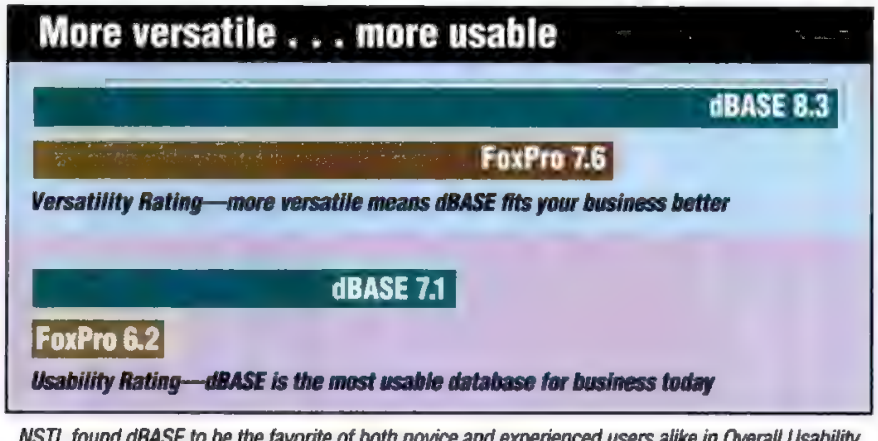
Intuitive tools eliminate guesswork

The dBASE Control Center puts you in charge, with the power to see and access everything at a glance. Its straightforward, task-oriented interface gives you single-keystroke or mouse-click access to dBASE's power. So you can perform all your daily tasks without ever seeing a dot prompt (unless, of course, you *want* to). And the Control Center's open architecture makes it easy to enhance or customize your own dBASE applications by incorporating third-party add-on products. No wonder NSTL rated dBASE tops in versatility and usability.* And why *ComputerWorld* ranked dBASE the #1 PC development tool for DBMS client/server software.

Get results fast

Powerful Design Tools let you create database tables, queries, data entry forms, reports, labels, and applications interactively. So you can see the results onscreen as you work.

Versatile Report Writer gives you the widest choice of report styles available, with many text enhancement features to add clarity to your data.



*NSTL found dBASE to be the favorite of both novice and experienced users alike in Overall Usability and Versatility.**

dBASE IV

of every business day!

I/S prefers doing business with dBASE

	Borland dBASE	Microsoft® FoxPro
Installed in Company	#1	#5
Best Technology	#1	#4
Best Price/Performance	#1	#3
Best Service/Support	#1	#5
Best Documentation	#1	#4
Prefer to Do Business With	#1	#4
Plan to Buy	#1	#4

Source: 1992 *ComputerWorld* I/S Brand Preference Study

*The latest **ComputerWorld** Preference Studies show dBASE outranks the competition in 12 out of 14 categories.*

Easy Label Designer includes formats for mailing labels, name badges, even Rolodex cards. You name it—you're only a few keystrokes or mouse clicks away from having it on your desk.

The world's #1 database keeps getting better

New dBASE IV comes complete with pull-down menus and mouse support, so you're never more than a click away from your data.

IQ!™ technology, dBASE's exclusive Index Query optimizer, finds the fastest way to get the answers you want from your database—automatically—even in the most complex network environments. Our relational Query By Example lets you manipulate your data quickly and easily. All you have to do is select the fields you want, and *presto*—instant results!

Fast new auto-install program practically installs dBASE by itself. It has never been easier to get started with a professional database.

Sophisticated tools for power developers

Power developers will like dBASE IV's 40 work areas, IBM® SAA-compliant SQL, plus many new functions and commands. The Template Language is now included free. We've enhanced BLANK support. And dBASE's automatically generated code can be combined with your own custom programming for unmatched speed and flexibility in creating new applications.

Create applications easily

Even novice users can create custom solutions with dBASE. When you're finished designing your database tables, labels, and reports, tie them all together as a complete application with dBASE's easy-to-use Application Generator. And you do it all without programming! Keeping track of your data and putting it to work for you has never been easier.

Get your work done faster—get new dBASE IV today!

Whether you're a database user, MIS manager, applications developer, or even a CIO, it pays to standardize on the standard.

See your dealer today or call now, 1-800-331-0877, ext. 6320

In Canada, call 1-800-461-3327

Call now and we'll send you the fact-filled white paper on dBASE usability, *free*!

BORLAND

Software Craftsmanship

*Software Digest Rating Report, Multiuser Database Programs, May 1992, Vol. 9, No. 2. Copyright © 1992 Borland International, Inc. All rights reserved. dBASE, dBASE IV, and IQ! are trademarks of Borland International, Inc. BI 4578

CIRCLE 285 ON READER SERVICE CARD

number of ports); Font Commander ESI-2640A, $1,195. Extended Systems, 5777 N. Meeker Ave., Boise, ID 83704; 800-235-7576, 406-587-7575; fax, 208-377-1906.
Circle 403 on reader service card

NEW

Logitech's CatchWord Pro: OCR Software for Windows

Logitech, maker of popular hand scanners, has unveiled a new Windows-based OCR (optical character recognition) software optimized for text acquisition with hand-held and flatbed scanners. CatchWord Pro, Version 1.0, digitally converts scanned text for use in Windows applications such as Excel and Word for Windows. It has features designed for hand-held scanners, such as deskewing; a multiple document interface; horizontal/vertical full-page merge (stitching); page composition; and OCR text editing tools. CatchWord Pro is TWAIN-compliant, allows direct scanning by any compliant scanner, and recognizes text scanned by other scanners and imported as a graphics file.

•List price: *CatchWord Pro, Version 1.0, $299. Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; 800-231-7717, 510-795-8500; fax, 510-792-8901.*
Circle 404 on reader service card

NEW

New Pen Vendor Wants Its Slice of the PI

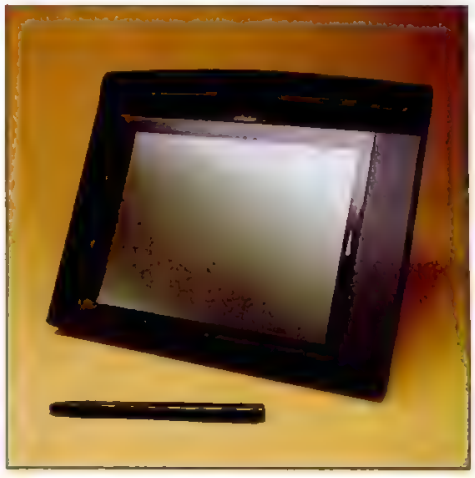
Sensing that the most successful pen-based systems will be targeted at industry-specific vertical applications such as health care and field sales, **PI Systems** has introduced not only an unusually light and powerful pen machine but also its own operating system and software development kit.

The Infolio, an $1,895, 3.4-pound pen system that runs up to 12 hours on 8 AA batteries, is based on a 16-MHz, 32-bit Motorola MC68331 processor and has three Type I PCMCIA slots (with a 2MB RAM card included) and an RS-232 port. The screen is a 640-by-480 resolution Sharp-built reflective LCD. Software includes an address book, calculator, clock, and notepad.

Host-based Point2 point software, also developed by PI Systems, is used to upload data to, and download data from, the pen machine.

Along with the Infolio, PI Systems has announced the $1,095 Windows-based Proforma-SDK development environment for Infolio applications. One interesting feature: a technology called Logical Communication that lets you write applications that automatically sense when it's time, for example, to move to the next form so that the user doesn't have to take the step of saving data.

•List price: *Infolio, $1,895. PI Systems Corp., 10300 S.W. Greenbury Rd., #500, Portland, OR 97223; 503-293-9585; fax, 503-293-9590.*
Circle 405 on reader service card



The 3.4-pound Infolio runs up to 12 hours.

IMPROVED

BrainMaker, BrainMaker, Make Me a Brain...

California Scientific Software's new BrainMaker and BrainMaker Professional neural network development systems now allow the addition of hidden-layer neurons during training. The updates, Version 2.5, have output file formats that are now programmable, and trained networks can be saved with weight matrices and training parameters.

BrainMaker Professional 2.5 supports up to 32,768 input neurons and now includes Netmaker Data Correlator, which reveals key relationships between any two variables, along with optimum lag times. The NetMaker utility helps configure data and imports Excel, Lotus 1-2-3, dBASE, binary, and ASCII data files. You can prune at least the significant neurons and specify all learning parameters for each neuron layer to speed training and improve pattern recognition and generalization, according to the company. BrainMaker 2.5 features a new menu driver, Commander, that facilitates training fact files with text, numeric, and pictorial data combined.

•List price: *BrainMaker Professional, Version 2.5, $795; BrainMaker, Version 2.5, $195. California Scientific Software, 10024 Newtown Rd., Nevada City, CA 95959; 916-478-9040; fax, 916-478-9041.*
Circle 407 on reader service card

BRIEFS

PRINTERS

Darius Technology Ltd. is shipping the Darius LaserFlow printer ($4,600), a 16-page-per-minute, 300- by 300-dot-per-inch print resolution tractor-feed laser printer. The unit offers HP PCL 4 emulation with extensions to handle graphics and provide graphics format compatibility, full compatibility with all LaserJet II soft fonts, and built-in connectors for two LaserJet II–compatible font cartridges. 206-483-8889; fax, 206-486-2577.

Digital Equipment Corp. has unveiled a 32-ppm, 300- by 300-dpi print resolution network laser printer and software for network printing in Sun, OSF/1, Unix, and VMS environments. The PrintServer 32 ($23,900) network printer handles print volumes of up to 15,000 pages per month in either single or duplex printing mode, according to the company. 800-344-4825; fax, 800-234-2298

Epson America is shipping the Action Printer 2250 ($199), a 9-pin version of the ActionPrinter 3250. The 10-pound dot-matrix unit offers draft-quality output speeds of up to 240 characters per second. 800-922-8911.

Fujitsu Computer Products of America has announced two laser printers; the PrintPartner 10W ($2,450) and the PrintPartner 10 ($1,995). The PrintPartner 10W is optimized for Windows and is based on the AMD-29000 15-MHz RISC processor. It has embedded TrueType fonts and provides output speeds of up to 10 ppm with 300- by 300-dpi print resolution. The PrintPartner 10 is based on the AMD-29005 15-MHz RISC processor and can be optimized for Windows printing via the installation of a TrueImage board ($499). 800-626-4686, 408-432-6333.

General Parametrics has unveiled the SpectraStar Q10 color thermal printer ($4,999), featuring an Intel 80960 RISC processor running at 20 MHz, 6MB RAM, and 20 fonts. The Q10 produces PostScript Level 2 images and includes Pantone-certified color matching. 415-524-3950

IMPROVED

Quotemaster Plus Comes to Windows With More Quotes

PennComp Software Development has unveiled an update to its quotation database with new searching capabilities and a database of quotations related to government and politics. Quotemaster Plus 2.0 for Windows lets you search for quotations by topic, author, keyword, and era. A new search engine will locate any word or part of a word entered in the search box. The Hierarchical Search feature helps isolate a quotation by searching three broad topics and finding specific quotes that relate to all three. Your favorite quotes can now be stored in a separate database for reference.

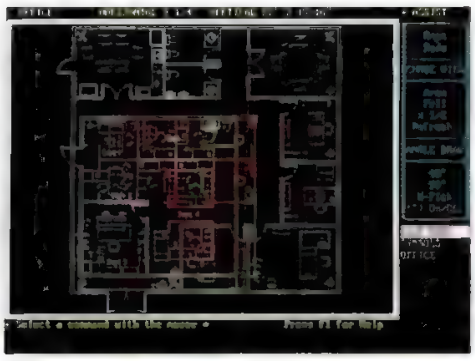
•List price: *Quotemaster Plus 2.0 for Windows, $89; Author Information System, $45; Quotepacks, $60 each. Quotemaster Plus 2.0 for Windows Professional System (contains base system, four Quotepacks, and the Author Information System), $374; PennComp Software Development, P.O. Box 271529, Houston, TX 77277; 800-326-6145, 713-669-0965; fax, 713-669-1014.*

Circle 408 on reader service card

NEW

I See a Reception Desk Here, A Conference Room There...

Autodesk Retail Products is shipping Office Layout, Version 1.0, a software package that lets you graphically plan and rearrange office space and manage inventory. The $149.95 DOS-based program has self-guiding menus, an on-line help utility, and more than 200 symbols of office equipment, partitions, desks, tables, and chairs. The symbols are color-coded and are available in a range of standard sizes. A 25-step undo/redo feature lets you experiment with various layouts in your plan and correct mistakes quickly. Symbols can be tagged with tracking information such as department, user, manufacturer, style, serial number, price, and up to five customized fields of additional information. Reports can be generated or exported into spreadsheets, databases, or desktop publishing programs in ASCII, .CSV, .DBF, EPS, or .WK1 file formats. Measurements in Office Layout can be displayed to 1/16 of an inch, and plans can be exported to AutoCAD, AutoSketch, or Generic CADD.



Office Layout lets you be the designer.

•List price: *Office Layout, Version 1.0, $149.95. Autodesk Retail Products, 11911 North Creek Pkwy. South, Bothell, WA 98011; 800-228-3601, 206-487-2233; fax, 206-483-6969.*

Circle 409 on reader service card

BRIEFS

PRINTERS

LaserPrint Corp. has unveiled the LPC-08M-2 MICR Machine ($2,995), a laser printer designed to produce bank checks from plain paper. The 8-ppm, 300- by 300-dpi print resolution unit has 1.5MB RAM (upgradable to 3.5MB RAM) and an additional .5MB RAM containing 80 typefonts—including E13B and CMC7 international check fonts. 800-678-6427, 305-772-6494; fax, 305-772-5470.

Lexmark is shipping the IBM Portable Printer ($549) and the IBM 4070 IJ personal ink jet printer ($599 for the Model 1 with 50-sheet feeder; $499 for the Model 2 without a sheet feeder). The IBM Portable Printer is available in either raven black or pearl white and uses thermal-transfer print technology on plain paper. The unit weighs 2.5-pounds and provides a 360- by 360-dpi print resolution. The IBM 4070 IJ personal ink jet printer provides a 360- by 360-dpi print resolution. 800-426-2468. Lexmark has also introduced the IBM 2390 PS/1 Printer ($499), a 24-pin, narrow carriage dot-matrix printer that offers print speeds of up to 200 characters per second in FastDraft mode. It provides a 360- by 360-dpi print resolution. 800-358-5835.

Mannesmann Tally is shipping the MT360 ($2,695), a 720 character-per second, 24-pin serial-impact dot matrix printer designed for high volume applications and rated by the manufacturer at over 20,000 pages per month. 206-251-5500.

Olympus Image Systems has announced two new 20 page-per-minute network printers that use the company's 300- by 300-dpi print resolution electron imaging engine. The IS2030 ($6,995) is designed for connection to multiple networks, and the IS2016D ($5,995) is designed for use with Sun Microsystems workstations. The IS2030 uses an Intel 960 RISC processor and comes with 4MB RAM. In addition, it includes an interpreter for TrueImage PostScript, and LaserJet II, III, and IIISi emulation. 714-553-5935.

NEW

Mirror for Windows 1.0 Lets You Access On-Line Services

SoftKlone, maker of DOS-based communications software, has unveiled Mirror for Windows, Version 1.0, a PC data communications and terminal emulation software package featuring a single-click dialing directory, support for more than 175 modems, access to shared network modems, and LAN connection support.

Not simply a port of the company's DOS-based Mirror software, Mirror for Windows has an installation program that lets you select a modem type, LAN communication protocol (DEC LAT, Telnet, and so forth), and communication port. Users have the option of setting up dialing directory entries and logging on macros for on-line services such as CompuServe, Dow Jones News Retrieval, and MCI Mail. The installation program will also convert command files and dialing directory entries from the DOS version to the Windows version. Mirror for Windows also supports DDE (dynamic data exchange), allowing data downloaded from an on-line service to be automatically placed into a Windows application.

•List price: *Mirror for Windows, Version 1.0, $195. SoftKlone, 327 Office Plaza Dr., #100, Tallahassee, FL 32301; 800-634-8670, 904-878-8564; fax, 904-877-9763.*

Circle 410 on reader service card

IMPROVED

Conversion Artist Gains Add-On Interface, Imaging Modules

North Coast Software's update of its Windows bitmap imaging product, Conversion Artist, Version 1.1, supports 32 bitmap formats and provides support for add-on modules, including a suite of new imaging modules the company is making available. Conversion Art-

ist offers image conversion, color reduction, screen capture capabilities, and printing. The new version also includes the addition of seven new file formats such as Macintosh raster PICT and WordPerfect Bitmap, as well as seven new dithering techniques for color reduction. It has an improved display of TrueColor images in standard VGA and enhanced support for Windows metafiles.

The add-on modules North Coast Software offers include: the JPEG image-compression module, which provides compression of up to 30 times the original image size; the DYCAM module, which provides a direct interface for the Dycam digital camera; the SV6600 module, which lets Conversion Artist print directly to the Kodak 6600 thermal printer; and the IMAGE module, which provides a number of image editing techniques such as scaling, cropping, rotation, tilting, and image masking.

•List price: *Conversion Artist, Version 1.1, $149.95. North Coast Software Inc., P.O. Box 459, 18A Shipley Rd., Barrington, NH 03825; 603-332-9363; fax, 603-332-9398.*

Circle 411 on reader service card

NEW

Peer-to-Peer Networking Under DOS and Windows in One Box

Buffalo Products is shipping Complete Network, a peer-to-peer network solution that provides all the hardware and software needed to connect 2 to 30 PCs in a single box. Available in configurations of 2, 5, 10, 15, and 30 nodes, Complete Network includes network operating system software (Webcorp's WEB 3.0 NOS), network interface adapter cards (Intel's EtherExpress 16 Network Adapters), wire, connectors, and a stripping tool. According to the company, the EtherExpress 16 Network Adapters are self-configuring, with no dip switches or jumper settings to change. The two-node version of Complete Network is priced at $395 and includes WEB 3.0 NOS with a two-node license, two EtherExpress 16 Network Adapters, 50 feet of RG58 Thin Ethernet coaxial cable with connectors installed, and two Thin Ethernet terminators. A $225 Add-A-Node package is available with one node software license, an adapter card, and additional cable. Realizing that networks are playing an increasingly important role in the office environment, Buffalo Products provides you with an easy and expandable means of experiencing the benefits of a peer-to-peer network.

•List price: *Complete Network, $395. Buffalo Products Inc., 2805 19th Street SE., Salem OR 97302; 800-345-2356, 503-585-4314; fax, 503-585-4505.*

Circle 412 on reader service card

BRIEFS

PRINTERS

NewGen Systems has introduced a new line of PostScript–compatible laser printers for high-volume applications. The TurboPS/440 ($5,795) and the TurboPS/440ND ($6,495) are based on Canon's 17 ppm LPB-NX print engine and a Weitek XL-8220 25 MHz RISC processor, and they offer 400- by 400-dpi print resolution. Designed to be shared by up to 25 users on a network, the TurboPS/440 and the TurboPS/440ND provide 8MB and 12MB RAM, respectively, in standard configuration. Optional internal hard disks are available in configurations of 50, 105, and 240MB 800-756-0556, 714-641-8600; fax, 714-641-2800

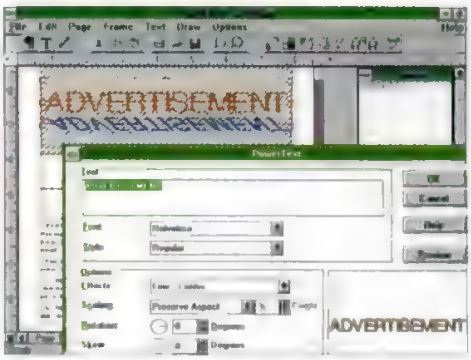
QMS has unveiled the PS 3200 ($19,995), a 32 ppm laser printer that connects directly to an Ethernet or Token Ring network, eliminating the step of moving data through a print server, resulting in true 32 page-per-minute print speeds. The unit is based on MIPS Technologies' R3000 RISC processor running at 25 MHz. It includes a bidirectional communications feature necessary for TCP/IP and DECnet network environments. It has 16MB RAM standard, two 250-sheet paper trays, a 100-sheet output tray, and a 1,500-sheet output stacker. The company has also introduced the QMS 860 Print System ($4,495), featuring the Canon LBP-BX engine, supporting 11- by-17-inch printing at 600- by 600-dpi print resolution. 800-523-2696, 205-633-4300, fax, 205-633-4866

Star Micronics America has unveiled the NX-1040 Rainbow ($269), a color dot matrix printer offering the choice of red, yellow, blue, green, orange, violet, and black printing at 180 characters-per-second in draft mode and 75 cps in NLQ mode. The unit has 12 resident fonts (2 in draft mode and 8 in NLQ mode) and up to 10 character sizes. It has Auto Emulation Change (AEC), which allows the unit to automatically detect and change its emulation (Epson LX-810/EX-800 or IBM Proprinter III). 800-447-4700, 212-986-6770, fax, 212-286-9063.

IMPROVED

Publish It! Comes to Windows With a Low Price Tag

Timeworks is shipping a $149.95 Windows version of its recently updated Publish It!, Version 3.0. Publish It! for Windows offers a number of advanced desktop publishing capabilities, such as control of kerning and leading, and word and letter spacing. It has paragraph tags and style sheets, frame borders, and text wraparound control. A feature unique to the Windows version is PowerText, a built-in text manipulation tool that lets you create text effects



PowerText lets you create text effects.

with functions such as rotation, skewing, mirroring text, and running text along a curve. Publish It! for Windows ships with Adobe Type Manager for Windows and 25 Type 1 fonts.

•List price: *Publish It! for Windows, $149.95. Timeworks Inc., 625 Academy Dr., Northbrook, IL 60062; 800-535-9497, 708-559-1300; fax, 708-559-1399.*

Circle 413 on reader service card

NEW

YOU/2: It's Not a Spy Plane

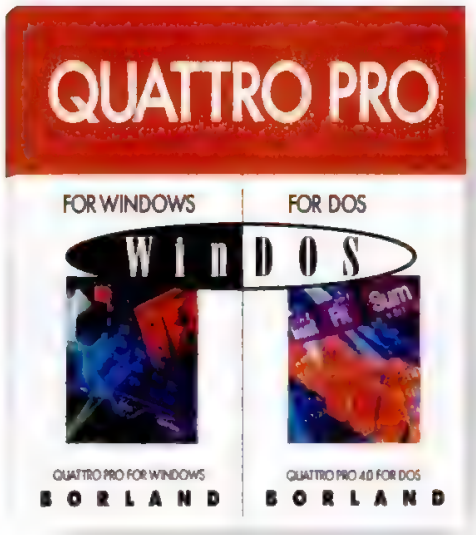
National A.I. Lab has unveiled YOU/2, a GUI-oriented, PC-based decision-support software program that lets you build and distribute knowledge bases. The package is aimed at professionals, technical support personnel, and managers and lets individuals pass on procedures and information for any situation in which "if-then" statements are applicable.

The YOU/2 Developer's Version ($795) has a spreadsheet interface that lets you enter data in columns and rows, making it easy to cut, copy, and paste between worksheets, according to the company.

•List price: *YOU/2 Developer's Version, $795; YOU/2 Runtime Version, $495. National A.I. Lab Inc., 2161 Newmarket Pkwy., Marietta, GA 30067; 800-526-6245, 404-988-0909.*

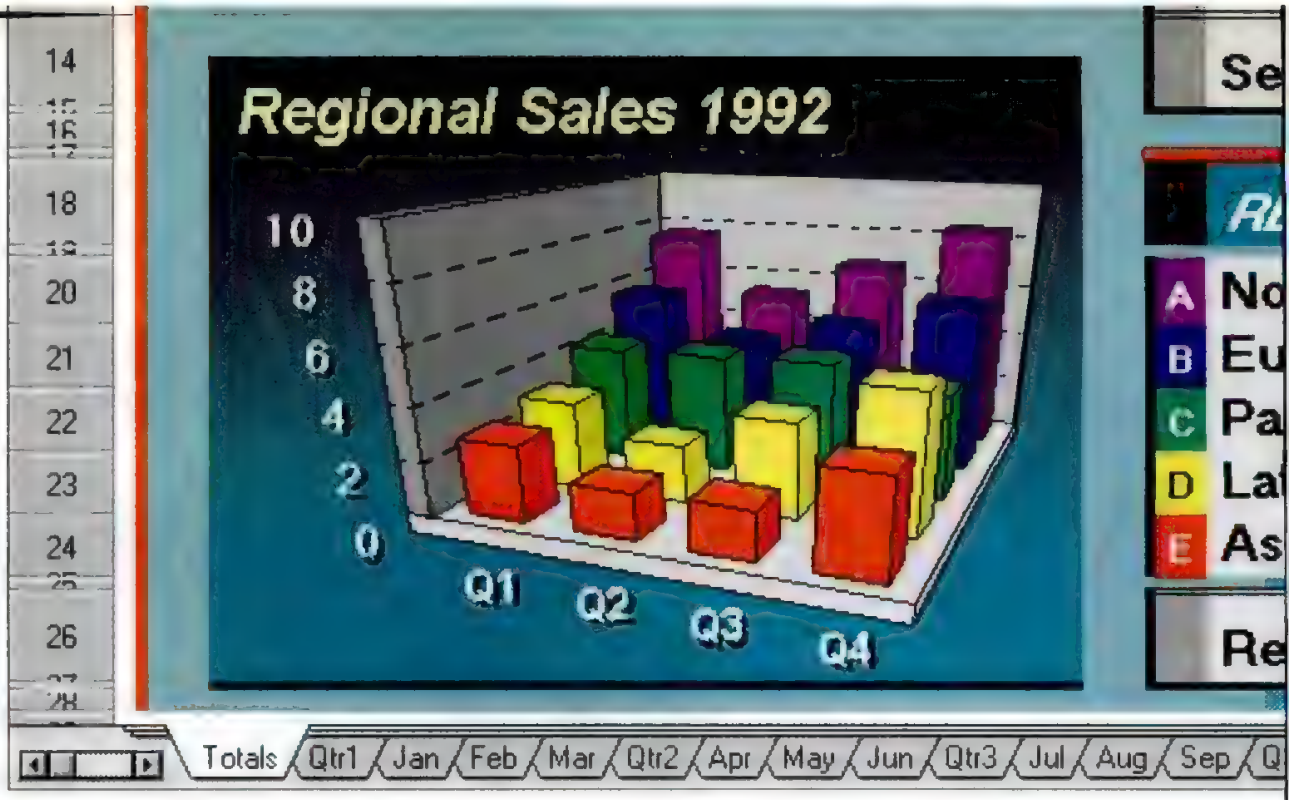
Circle 414 on reader service card

The most advanced Windows spreadsheet starts with an elementary concept



Introducing Quattro® Pro for Windows.

BORLAND



...Spreadsheet

Quattro Pro for Windows *is the most usable spreadsheet ever made. Built with Borland's renowned object-oriented technology, Quattro Pro for Windows* is packed with hot new features you won't find in any other spreadsheet.*

NEW! Spreadsheet Notebooks* with customizable Tabs are nothing less than a revolution in spreadsheet ease of use. Now you can intuitively organize and manage your spreadsheet data.

NEW! Object Inspector™ menus end the hassle of searching through menus. They're simpler than 1-2-3. Just click the *right* mouse button anywhere on the screen to get a list of what you can change and change it right there.

NEW! Database Desktop is the easiest way to incorporate dBASE® and Paradox® data into your spreadsheet. Just what you'd expect from Borland, the leader in database technology.

NEW! SpeedFill™ and **SpeedFormat™** slash setup time by automatically filling in spreadsheet headings and formats.

NEW! SpeedBars™ are context-sensitive and customizable. SpeedBar icons give you pushbutton access to your most frequently used commands.

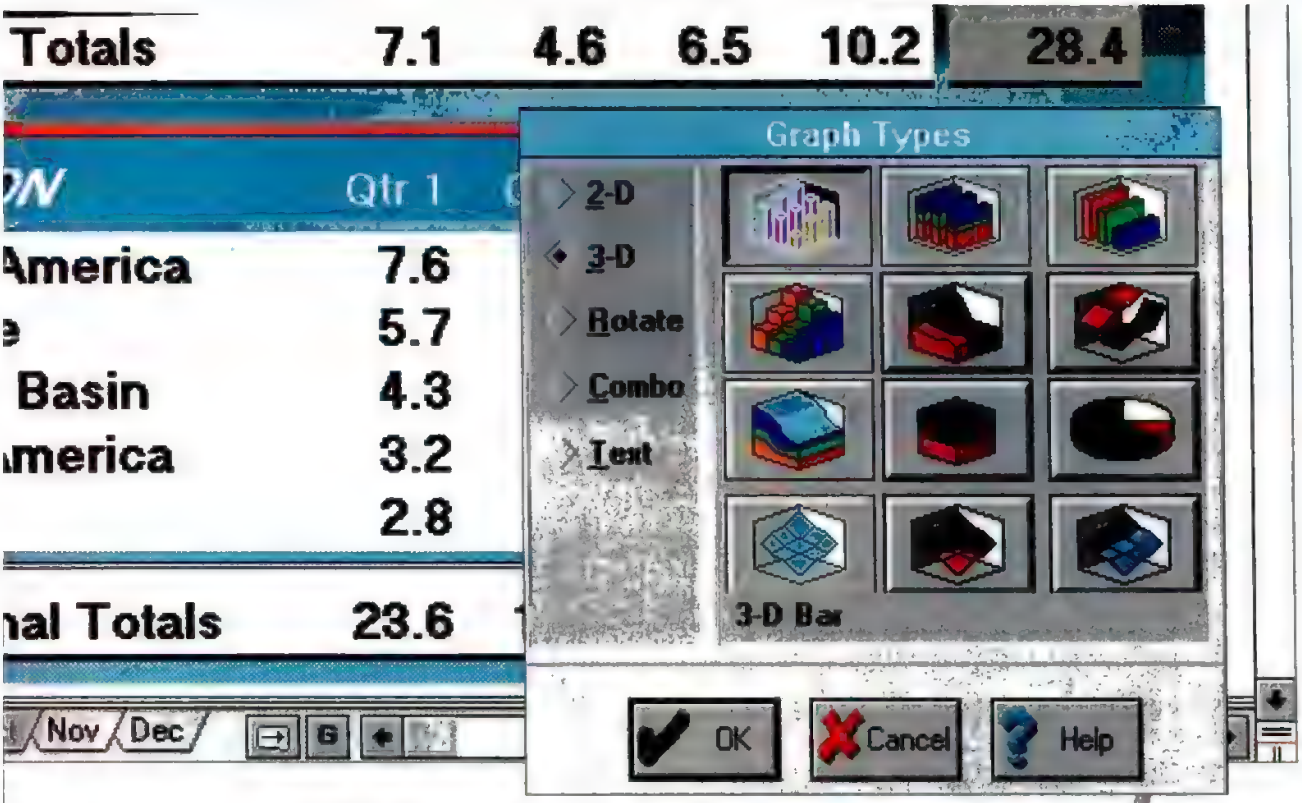
NEW! Presentation Graphics and drawing tools that rival those of Freelance and Harvard Graphics are built-in. You don't need to buy a separate graphics package.

YES! Compatible with Lotus 1-2-3 files, macros, and publishing styles and with Excel .XLS files.

Find your spreadsheet information in a flash!

From everyday tasks to complex projects, Spreadsheet Notebooks are the easiest way to work with your spreadsheets. By incorporating multiple spreadsheet pages in a single file (one notebook can handle up to 256 spreadsheet pages), you can break any complex spreadsheet into easy-to-manage pieces. Assign meaningful names to your notebook tabs and finding information is as easy as flipping through a notebook.

Notebooks are the smart way to do 3-D spreadsheets! You can present data in flip-chart style and format pages in a group, like chapters. Because you navigate easily, it's simple to build multi-page models.



Notebooks

You may never open the manual

Quattro Pro for Windows is the most usable spreadsheet ever. With Quattro Pro for Windows' object-oriented user interface, every action you take is easier and faster.

OBJECT INSPECTOR™ The Right Choice

Object Inspector menus let you make one-step changes to any object on your screen with just a click of the *right* mouse button—no more searching through layers of pull-down menus.

Context-sensitive, customizable **SpeedBars**™ give you pushbutton access to your frequently used commands. **Drag and Drop** lets you move or copy data instantly with the mouse.

Built-in graphics rival standalone packages

Quattro Pro for Windows gives you extraordinarily powerful graphics tools *built-in*. You'll never have to learn a separate graphics package.

Get 35 2-D and 3-D graph types—with thousands of variations. Then enhance your graphs by adding text, lines, arrows, and built-in clip art.

Use the **Slide Show** and **Light Table** to create incredible electronic presentations. Arrange and rearrange slide shows in seconds and customize them with dazzling transition effects.

You can create 35mm slides and overheads, too. No other spreadsheet gives you all this presentation power.

*Quattro Pro for Windows and Spreadsheet Notebooks have patents pending.

Quattro Pro beats

Other spreadsheets don't compare

FEATURE	QPW	EXCEL 4.0	1-2-3/W R1.1	1-2-3 R2.4	1-2-3 R3.1
ORGANIZATION					
Spreadsheet Notebooks	Y	N	N	N	N
Nameable Tabs	Y	N	N	N	N
Group Formatting on Selected Pages	Y	Y	N	N	N
True 3-D Consolidation	Y	N	Y	N	Y
EASE OF USE					
Right Mouse Button Formatting	Y	Y	N	N	N
Object Inspectors	Y	N	N	N	N
Context-sensitive SpeedBars	Y	Y	Y	N	N
SpeedFill and SpeedFormat	Y	Y	Y*	N	N
Drag and Drop	Y	Y	N	N	N
GRAPHICS AND PRESENTATIONS					
3-D Graphs	Y	Y	N	N	N
Slide Show with Light Table	Y	N	N	N	N
Live Linked Graph Types and Formatting in Slide Shows	Y	N	N	N	N
DATABASE ACCESS					
Live View of Networked Database Tables	Y	N	N	N	N
Database Desktop	Y	N	N	N	N
CUSTOMIZATION					
Macro Buttons on Spreadsheet	Y	Y	N	N	N
Visual User Interface Builder	Y	N	N	N	N
COMPATIBILITY					
Reads Quattro Pro, Excel, 1-2-3 Files and Styles (including Allways & Impress)	Y	N	N	N	N
Runs Your QPro & 1-2-3 Macros†	Y	N	N	N	N
ANALYSIS					
Optimizer	Y	Y	Y	N	Y

*Requires add-in

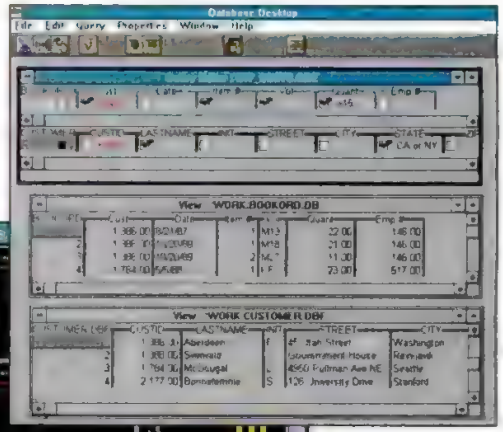
†Some 1-2-3 macros may require modification

Outstanding 1-2-3 and Excel compatibility

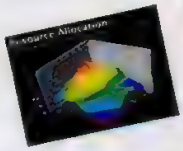
Quattro Pro for Windows is the next-generation Windows spreadsheet. It is the *only* spreadsheet that gives you both innovation *and* compatibility with Lotus 1-2-3, Excel, and Quattro Pro. Quattro Pro for Windows supports 1-2-3 files, macros, and publishing styles, including Allways, Impress, and WYSIWYG. It also supports Excel .XLS 3.0 and 4.0 files. What's more, Quattro Pro for Windows is much more compatible with 1-2-3 than Excel. For example, unlike Excel, Quattro Pro formulas, ranges, and command actions (like moving blocks) work as 1-2-3 users would expect.

Fast database access to dBASE and Paradox

Only Quattro Pro for Windows gives you easy access to database information. Borland's unique Database Desktop™ lets you view, edit, and copy dBASE and Paradox tables *directly* from within Quattro Pro. And *only* Quattro Pro for



The Database Desktop: Only Borland makes access to dBASE and Paradox data this easy with QBE.



Only Quattro Pro for Windows gives you a Light Table to arrange your electronic slide shows in seconds.

1-2-3 and Excel!

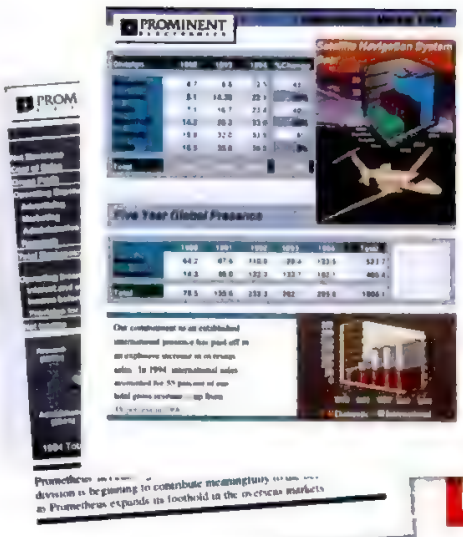
Windows has Query By Example, so you can ask questions about your data with point-and-click ease. Since it's from Borland, the database leader, you can count on it working right even in network environments.

Create custom applications in minutes

Because of its object-oriented design, *only* Quattro Pro for Windows makes it easy to customize your spreadsheet. All the tools are there for you to create your own custom dialog boxes, powerful time-saving macros, and SpeedBars.

Don't settle for second best

Get the spreadsheet from the company that J.D. Power and Associates ranked #1 (tied with WordPerfect) in Customer Satisfaction Among Business Users.* Get Borland's Quattro Pro for Windows today!



WinDOS™

Quattro Pro for Windows and DOS now together for the price of one!

Imagine! Getting the world's best Windows spreadsheet and best DOS spreadsheet for the price you'd ordinarily pay for just one. We call it WinDOS, an unprecedented offer that makes the transition from DOS to Windows fast, easy, and painless.

Buy Quattro Pro WinDOS because it's the hands-down best Windows spreadsheet, and get the top DOS spreadsheet FREE! Or buy Quattro Pro WinDOS because it's the absolute best DOS spreadsheet, and move to Windows at your own pace—your Windows spreadsheet is already bought and paid for.

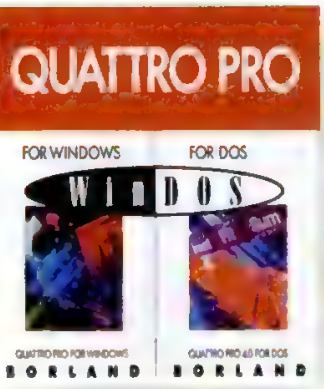
See your dealer today or call now!

1-800-331-0877, ext. 6854

In Canada, call 1-800-461-3327

Limited-time offer!

"Quattro Pro for Windows is [what] Lotus should have released, but didn't."
InfoWorld



"Quattro Pro 4.0 [is] the ultimate DOS spreadsheet."
PC Magazine

BORLAND

Software Craftsmanship

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CIRCLE 287 ON READER SERVICE CARD

Accounting

CA-Supercalc (Special)	89
Intuit QuickBooks	89
Intuit Quicken Win	42
Peachtree Complete V (Special)	169
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CA-Cricket Presents (Special)	109
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Micrografix Windows Draw	95
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SW Publishing Harvard Graphics v3.0	389

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American Design CAD v5.0 2D	159
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Practical 2400 1/2 Card w. Sftwre INTL	79
Practical Peripherals 9600SA v.32 EXTL	289
Prodigy Start-Up Kit v3.1 w/2400 bp	99
Supratax Modem Plus DOS EXTL	129
Supratax Modem Plus Int(Win)	139
Symantec Norton PCAnywhere LAN v4.5	299
U.S. Robotics Courier v32BIS 14.4 EXTL	559
U.S. Rob Courier v32BIS 14.4 Fax EXTL	569
U.S Rob Cour HST DS v32 BIS EXTL	799
Zoom 2400BPS w/RPI Hrdwr EXTL	59

Database

Borland dBASE III Plus v1.1	459
Borland dBASE IV v1.5	485
Borland Paradox v4.0 (Special)	519
Buttonware PC-File v6.5	79
Fax Pro v2.0 DOS 6-Pack	549
Microrim R:BASE v3.1	429
SuperBase IV Windows v1.3	429
Symantec Q&A v4.0 (Special)	249
Word's Tech Arago Prof.	599

Desktop Publishing

Adobe Illustrator v4.0 (Special)	349
Adobe Type Fonts	Call
Adobe Type Manager Plus Pk	119
Aldus Freehand Win v3.1	389
Aldus Gallery Effects Win (Special)	129
Aldus Pagemaker v4.0 Win	478
Aldus PhotoStyler Win v1.1A	499
Caere Omnipage Pro Win v2.1	599
Contact ACT v2.1 (Special)	209
Corel Draw v3.0 Dsk & CD	379
Microsoft Publisher for Win V	123
Microsoft True Type Fonts Pack	24
Microsoft Word for Win v2.0	289
Z Soft PC Paintbrush 5+	89

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Broderbund New Print Shop Companion	29
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Microsoft Flight Simulator v4.0	37
Origin Sys. Ultima VII (Special)	44
Sierra On-Line Kings Guest V	39
SMC Automap (Special)	46
SMC Automap Europe	79
SMC Orbits (Special)	39
Softsync Expert Home Design	10
The Learning Co. Reader Rabbit	38

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REVIEWS OF THE LATEST BOOKS FOR THE PC USER

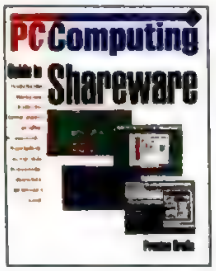
Edited By Carol Levin

Downloader's Delight: The Essentials of Shareware

BY BEN MYERS

There's one thing commercial software developers don't want us to hear: Shareware works, is reliable and well designed, and is supported and updated by its authors. But the whole concept of shareware is often misunderstood, and it seems like you have to be tapped in somehow.

In *PC/Computing Guide to Shareware*, longtime *PC/Computing* contributor Preston Gralla dispels the myths surrounding shareware and promotes it as "one of the last bastions of individual creativity left in the world of computing." By using shareware, Gralla says, "you're keeping alive the spirit of the earliest days of the PC, when marketing took a backseat to technology." Heady stuff.



Gralla does a fine job of initiating the shareware newcomer and updating experienced users. He's sorted through thousands of programs to come up with the 250 offerings he considers the best, and has neatly classified them into 13 categories. But first he reports on one not-to-be-overlooked issue: viruses. They've been known to piggyback onto legitimate shareware programs, and you'll learn to recognize symptoms of an attack, disinfect your system, and take precautions such as finding a reputable bulletin board service.

Gralla then summarizes each program, lists the developer's contact information, and includes occasional screenshots. In addition to word processors, spreadsheets, and databases, there are sections on finance and accounting, DOS shells, printer and disk utilities, Windows, communications, games, and educational software. The section titled "PC/Computing Top Ten Shareware Picks" is devoted to personal favorites, including PC-Write, QModem, As-Easy-As, and Commander Keen. The listing of shareware sources includes over 300 BBSs and disk vendors worldwide.

The two disks that come with the book comprise a basic shareware starter set of six programs: the {COMMO} communications program for accessing bulletin boards, Phil Katz's renowned PKZIP file-compression utility, Vernon Buerg's equally famous List file viewer, MacAfee Associates' ViruScan, Metz Windows Task Manager, and Magee Enterprises' Treeview shell for DOS.

Gralla has done an admirable job of finding the gems in the vast shareware universe. If you want to investigate shareware to augment or replace the software you already use, reading this book will save you dollars, many hours of searching and download time, and the trial and error of finding the right shareware.

GLOSSBRENNER ON SHAREWARE

Glossbrenner's Guide to Shareware for Small Businesses is both more and less than its title suggests. Alfred Glossbrenner—author of several computer books, small-business owner, and shareware distributor—devotes over one-third of the book to buying your first PC. In language easy enough for the PC newcomer, he explains the workings of all the major PC components and offers advice for buying a first PC: hardware selection, dealers versus superstores versus mail order, sources for support, and warranties.

His explanations are clear, thorough, and right on the mark for first-time PC owners. Eschewing bargain or used XTs and 286s, he recommends a 386SX as a minimum—shrewd advice for the long term in this era of plummeting PC prices. There's also a quick chapter on DOS, Windows, and system configuration.

The remaining two-thirds of the book explores the details of Glossbrenner's favorite "big four" shareware programs: PC Write, As-Easy-As, File Express, and Procomm. There are also chapters on shareware offerings in accounting and money-management software, business forms and graphics, utilities, and games.

Since his intended audience is the PC novice, he clearly believes that presenting a limited choice of software—about 30 products—is less likely to bewilder readers, who may already be a bit confused.

Glossbrenner's coverage goes far beyond software summaries and screenshots to include hands-on tutorials. Some chapters include technology refreshers, such as the exposé on fonts in the printer productivity tools and techniques chapter, and the overview of modems in the communications section. In addition to product-specific information, Glossbrenner cites the pros and cons of the various sources of shareware: nationwide information services like CompuServe, local bulletin boards, and mail-order suppliers.

The bundled disk is best described as a shareware tease. It has seven utilities and some sample data for the tutorials, but none of the "big four" explored in the book. To help remove the problem of "over-choice"—one of the obstacles to widespread shareware use—the book includes an order form for "Glossbrenner's Choice," a collection of 51 programs the author distributes at $5 a disk.

If you're even a somewhat experienced PC user who wants to explore lots of shareware, other books will offer more. If you're a novice or you haven't yet purchased the first PC for your business, Glossbrenner's guide will direct you to the necessary equipment and help you become productive, with a minimum effect on your pocketbook and your sanity level. □

• *PC/Computing Guide to Shareware*, by Preston Gralla, $34.95. Ziff-Davis Press, 5903 Christie St., Emeryville, CA 94608; 800-688-0448. ISBN: 1-56276-036-X.

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• *Glossbrenner's Guide to Shareware for Small Businesses*, by Alfred Glossbrenner, $27.95. Windcrest/McGraw-Hill, Blue Ridge Summit, PA 17294-0850; 800-233-1128. ISBN: 0-8306-3375-8.

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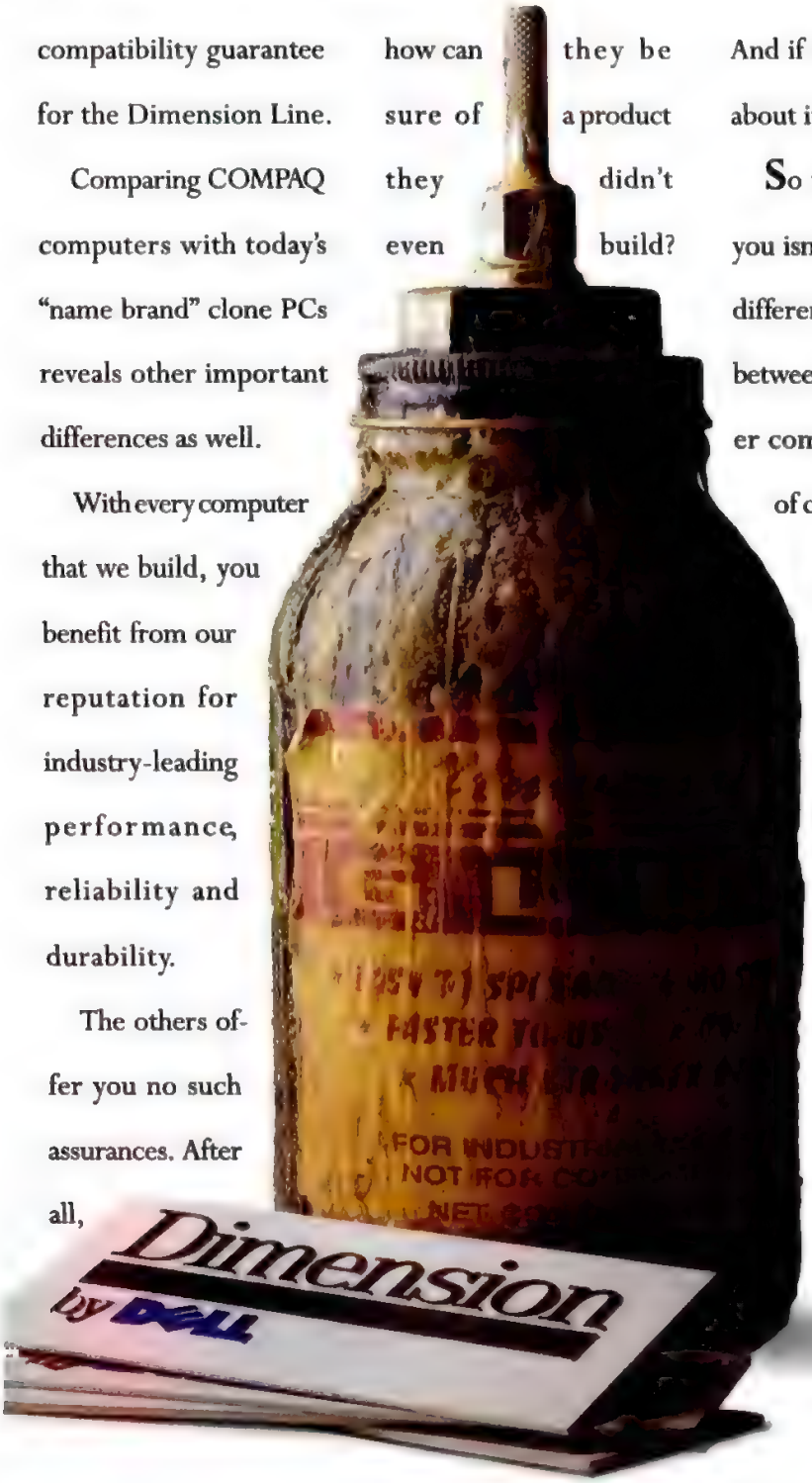

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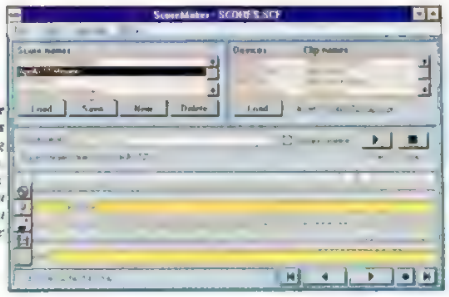

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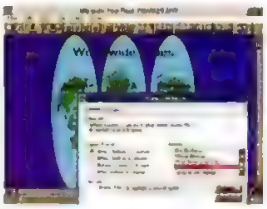

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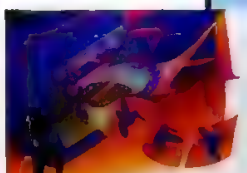

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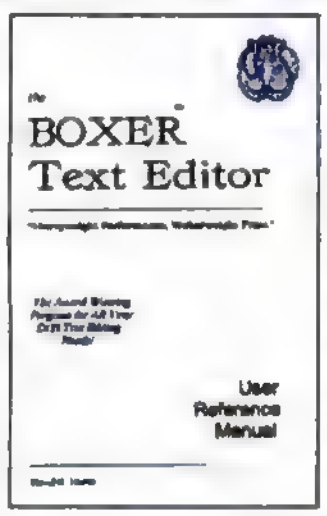
Edited by Trudy Neuhaus

Boxer Brings You High-End Features at a Low Cost

BY SCOTT MCGRATH

Boxer Text Editor, Version 4.0, promises programmers "heavyweight performance, welterweight price." And it delivers, with a feature set comparable to those found in many commercial text editors for programmers, yet with a price tag of only $35 ($50 for the manual and a free upgrade).



Boxer is a flexible editor with an extensive set of word processing options, such as word wrap, margin settings, headers and footers, and justification. Its full complement of search options includes regular-expressions search and replace, multifile search and replace, and brace matching for programmers. Boxer's printing functions sport a handy pagination feature that will number pages, adjust page lengths, and install headers and footers. A word count facility is also available.

To speed the editing process you can mark and manipulate blocks of text by character, by line, or by column (as a rectangular block). You can drop up to eight individual text anchors in each file and jump between them, and auto-indenting moves the cursor to the same column that started the preceeding line. In the event that another program has modified a file or you wish to cancel changes made to a file, just invoke the Reload File command and reload an entire file from disk. A multilevel UNDO command can store your edits on a stack that can have up to 4,096 levels. Then, as you use UNDO repeatedly, you'll move down the stack to restore previous versions of your text. Unfortunately, Boxer does not have a REDO command to restore an edit on which you accidentally executed the UNDO command.

Boxer has separate windows, which you can size, move, switch, scroll, and close using a mouse or keyboard commands. Cutting and pasting between windows is straightforward. Boxer implements up to 26 individual clipboards to which you can cut or copy text, and offers a clipboard manager to manipulate text blocks within the clipboards. Support for Personics' UltraVision is also built-in: Boxer can automatically detect UltraVision's presence and resize text windows—from within the editor—to any column and row size UltraVision makes available.

One unusual feature is Boxer's synchronized scrolling of windows. Choose this option and you can scroll all visible windows simultaneously, using the standard cursor navigation keys. This is handy for text comparisons between two very similar files, but becomes less useful when files diverge significantly.

Programmers by trade are a difficult crowd to please, tending toward religious attachment to their editor, a style of working with text files, and a given user interface. Hence, an editor can live or die by its configurability. Boxer provides a sophisticated series of options. You can choose from several keyboard emulations including WordPerfect, QEdit, Brief, Epsilon, Norton Editor, and of course die-hard WordStar. Then, using an external keymapping utility, you can further customize each of these. For example, you can set the cursor to move quickly in a Home-Home-Home keystroke progression to the beginning of the line, the top of screen, then the top of the document (or End-End-End to skip forward); and you can program new WordStar-style keystroke combinations. In addition, you can set a variety of start-up options, such as screen options, by configuring a single environment variable or by using command-line switches.

Programming support is aimed primarily at C and Pascal programmers; Boxer includes a set of template macros that fill in common expressions for those languages. Compiler support is configured in a small support file by filename extension, and Boxer provides a roomy DOS shell for compiler execution by swapping itself to EMS or disk while shelling to DOS.

Boxer's weakest points when compared with other professional editors such as Brief, Multi-Edit, and the Sage Professional Editor, are its lack of a programmable macro language and its incapacity to handle very large text files. Boxer does include a keystroke macro facility that works well for simple recorded macros, but it does not include a programmable facility for manipulating buffers nor other advanced features as the other editors do.

Boxer's capacity limitations are a more serious drawback: If you load a file larger than available RAM, Boxer will simply abort with an "Out of Memory" error and politely wait for a file it can handle. Since Boxer only takes advantage of conventional RAM for files, however, I had trouble loading files in the 400K to 500K range! To compensate, Boxer Software provides a utility that you can use to split files into small chunks. This utility works well and is a satisfactory workaround, but if you often work with large files, this becomes bothersome. Another workaround is to load the small chunks into several windows, but it probably won't be long before you receive the error message again. While Boxer swaps itself to expanded memory when shelling to DOS and for compiles, it doesn't use the extra memory for file capacity. Boxer Software is trying to remedy this without sacrificing performance.

Whether or not you already own a professional editor, you should go one round with Boxer and see how it fares against the competition. You may find Boxer's small size (it can fit on a 360K diskette) and speed just right for certain projects. It's fast, versatile, configurable, and, best of all, inexpensive. You can download Boxer as BOXER.ZIP from the Utilities/Tips Forum on PC MagNet or as BOX400.ZIP from IBMAPP on CompuServe. □

• Boxer Text Editor, Version 4.0

List Price: *$35. With manual and free upgrade, $50.* Requires: *Hard drive or 720K floppy disk drive, 384K RAM, DOS 2.1 or later. Boxer Software, P.O. Box 3230, Peterborough, NH 03458-3230; 800-982-6937, 603-924-6602*

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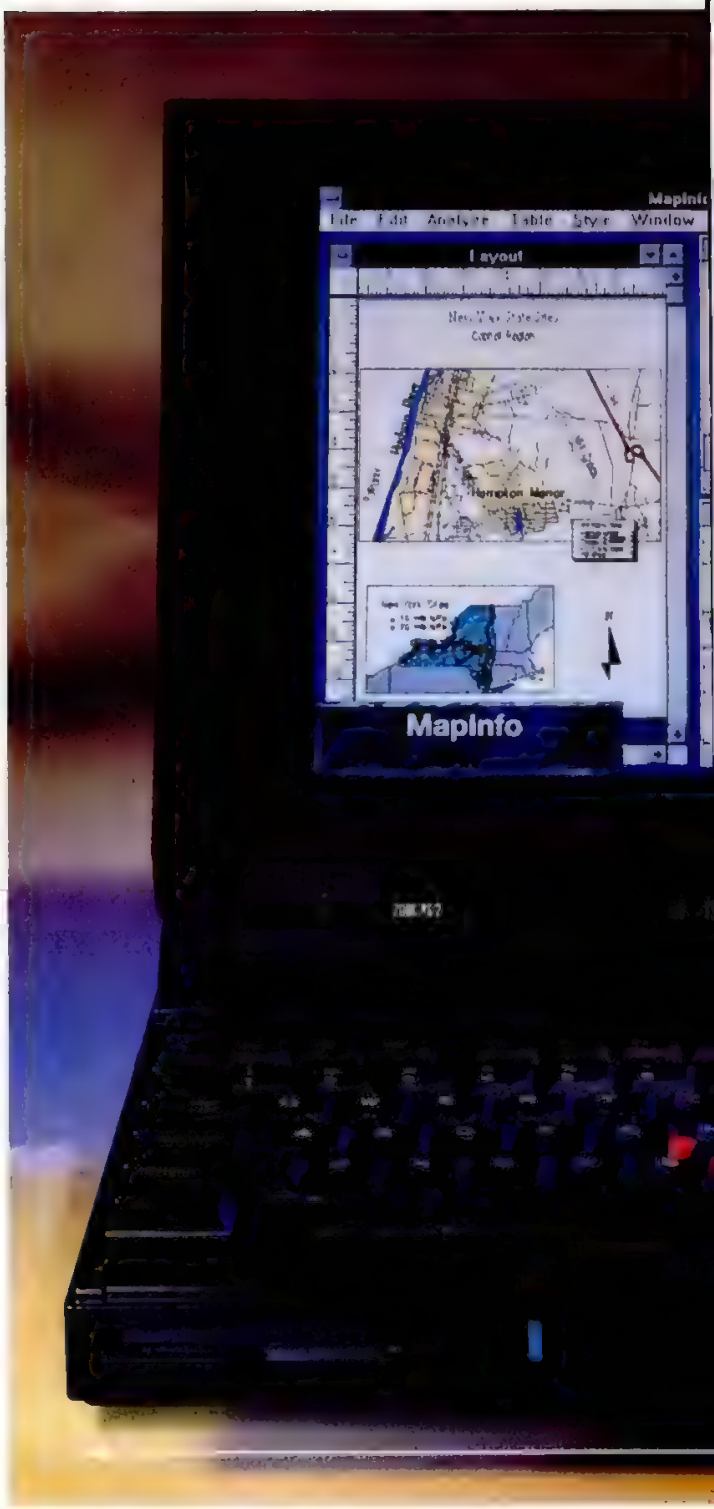
25 MHz power, an available 50/25 MHz processor upgrade, the largest 10.4-inch TFT 256-color screen (or a 9.5-inch 64 grayscale monochrome screen) and style to spare. If you like to think under a tree but know that money doesn't grow on one, the ThinkPad 300 series has the same slim design and an even slimmer price tag. And all ThinkPads are expandable, with a range of add-on products available.

IBM ThinkPads are easy on the eyes in more ways than one. Immediately apparent is their attractive silhouette. But their beauty extends far beyond the superficial. The 700 series screens rival desktop display clarity. All screens are eminently

*Warranty information available from the Personal Systems HelpCenter or an IBM authorized dealer. 700T warranty is available in the U.S.A. and Canada only. IBM is a registered trademark and ThinkPad, HelpWare and HelpCenter are trademarks of International Business Machines Corporation. © 1992 IBM Corp.



Use it wherever

readable and adjustable. In fact, everything about the ThinkPad is engineered to make life easier, from the full-size keyboard to the front-loading diskette drive. Some even have removable hard disks for easy upgrades, security and virtually unlimited storage.

ThinkPad	Model 700C	Model 700	Model 300
Processor	486 SLC/25 MHz	486 SLC/25 MHz	386 SL/25 MHz
Display	10.4" Active Matrix 256-Color Screen	9.5" Monochrome Display 64 Grayscale Screen	9.5" Monochrome Display 64 Grayscale Screen
Battery Life†	2–4 Hours	3.8–7.5 Hours	4–10 Hours
Weight	7.6 Lbs. with Battery	6.5 Lbs. with Battery	5.9 Lbs. with Battery
Warranty	3 Years (International)	3 Years (International)	1 Year (International)
Price††	$4,350	$2,750	$2,375

†Depending on usage and configuration. ††MSRP. Dealer prices may vary.

With the ThinkPad 700, we didn't just build a better mousetrap, we built a better mouse. The TrackPoint II, perfectly situated in the keyboard, lets you command the entire screen with one fingertip.

And every ThinkPad comes with IBM HelpWare™—a unique package of service and support featuring an international warranty* and round-the-clock, toll-free phone assistance. For more information or an IBM authorized dealer near you, call our Personal Systems HelpCenter™ 24 hours a day, 7 days a week at 1 800 772-2227.

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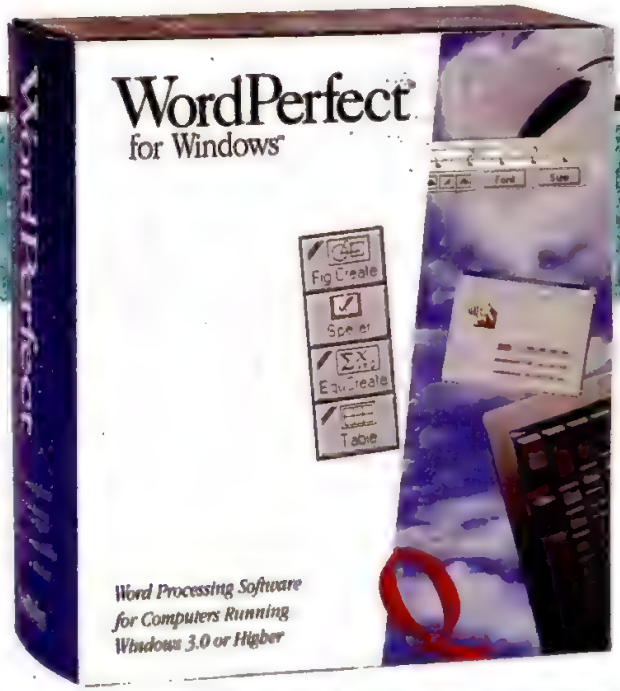

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Michael J. Miller

Communications Software Stinks!

Electronic mail is wonderful. It lets you communicate with co-workers, send information instantaneously, and hold conferences with lots of people who may not all be in the same location. Unfortunately, the software we use for electronic mail ranges from mediocre to terrible. Think about it: How many communications programs do you use? What are their limitations? Wouldn't it make more sense to have a single, great communications program that worked with all your sources of electronic communication?

HALF A DOZEN COMM PROGRAMS...

I regularly use half a dozen communications programs, not because I'm trying out new ones all the time, but because nothing I have does the whole job.

When I want to check my electronic mail inside the office, I use cc:Mail for Windows, because I run more Windows apps than anything else and because we use cc:Mail as our mail system. But when I'm on the road, I use a character-based version of cc:Mail Remote. Why? Because that's all Lotus offers so far. That I could live with, but cc:Mail Remote can't see the bulletin boards used by the network versions of cc:Mail.

Why? Nobody seems to know.

Much of the rest of Ziff-Davis uses Lotus Notes. Now, since Notes and cc:Mail both come from Lotus, you would think that the gateway between them would work quite well. Think again. So instead of having my Notes mail forwarded to cc:Mail, I have it forwarded to MCI Mail—it works better. Something isn't right here. To be fair, Lotus has a new Notes-cc:Mail gateway due out presently and plans new versions of both Notes and cc:Mail for later this year. These should solve some of the problems. But still, it's maddening.

Today, even the best electronic mail front ends only connect to one back end. If you want something that will get your mail from multiple services (like MHS, cc:Mail, Notes, and Microsoft Mail) all at once, you'll need special gateways, which are problematic at best. What we really need are transport-independent e-mail front ends. Yes, I know there are standards that are supposed to do this. VIM (Vendor Independent Messaging), a specification proposed by a group of vendors including Apple, Borland, IBM, Lotus, and Novell, and Microsoft's MAPI (Mail Application Programming Interface) are two such standards. I'll believe it when I see it.

Why should we have to put up with a different comm program for every kind of communications task?

...AND COUNTING

Of course, I have to use other communications programs as well.

I still get more MCI Mail than anything. For that I use the orphaned Lotus Express. Once you set it up, Express is completely automatic. It automatically polls on a regular basis (such as every three hours) and runs in the background, so all you have to do is switch to it (under Windows, OS/2, or DESQview) and see your new messages. While it's the best MCI front end currently shipping, it hasn't been upgraded in many years and has a lot of limitations. It has a reasonable folder system for storing your messages, but stringent limits on the number of messages per folder, and you can't store folders within folders. Also, Express may be the largest TSR program ever written—hardly designed for the 1990s.

Lots of folks are working on developing better MCI front ends, including MCI, which took over Lotus Express and promises an upgrade soon; Gnosis, which offers a shareware product called See Mail; and SWFTE, which is about to release its Windows MCI viewer, The Wire. You can even send and receive MCI messages through The Norton Desktop for DOS. Still,

they're all designed for MCI alone.

When I use CompuServe, I want to use a program that can keep track of the discussion threads in most of the forums, like the PC MagNet Editorial forum in the ZiffNet section of CompuServe. For that, again, I like a program that automatically downloads and sorts the threads. Programs able to handle these tasks include TAPCIS and OZCIS (for DOS), and Golden Compass (for OS/2). Personally, I use OZCIS, a great shareware program. It has its share of eccentricities, but it does a pretty good job if you want to send and retrieve CompuServe mail and manage forums and threads.

When I use Prodigy, of course, I have to use something different, namely Prodigy's own software. It's the only choice.

All the programs I've mentioned are special-purpose communications software. What about the more general-purpose asynchronous communications packages like Crosstalk, Procomm, and DynaComm? These programs give you a lot more flexibility in choosing which on-line services and bulletin boards you can work with. And they typically have rather sophisticated, powerful scripting languages. They're getting better and better—more scripts, better user interfaces, and, with programs such as MicroPhone for Windows, built-in fax and multimedia features. But they don't connect to standard office electronic mail systems, typically don't handle conversation threads, and are not nearly as automated as you would like. Having better built-in scripts to handle the common services would go a long way to making them better.

Let's see: internal e-mail, remote e-mail, MCI, CompuServe, Prodigy, and general-purpose communications. That's six programs, not counting fax software, remote dial-in programs, or even software for transferring files between two machines (à la LapLink). That's too much for me to work with and, I suspect, too much for anyone.

ONE GREAT COMMUNICATOR

What we need is one great communications program that will do it all. At a minimum, I want a program that can connect to all kinds of electronic mail back ends, ranging from MHS to cc:Mail to Microsoft Mail to Notes. One that works both over a LAN and remotely. One that can also poll mail through MCI, CompuServe, and Prodigy, and even handle threads.

This ideal program should put all your electronic mail from whatever source in a common in-box if you want it to. And it should manage the connections so that your replies take the same route back to the sender as the way they came. This great communicator should handle mailing lists that cross mail services. It should be able to poll the services automatically at the intervals you set. It should figure out when you're connected by a LAN, when you're connected by modem, and perhaps even when you're connected by wireless communications—so it will send and receive messages in the most efficient manner.

That's not to say there won't be a need or a use for other, more specialized communications programs. I doubt we'll see a general-purpose program anytime in the near future that has all of these features, so I'll probably continue to use multiple communications programs. But there is no technical reason that there isn't a general-purpose communications program that handles at least all the popular on-line services and gives you basic terminal emulation.

If such a program exists today, I haven't seen it. But I'm sure looking. □

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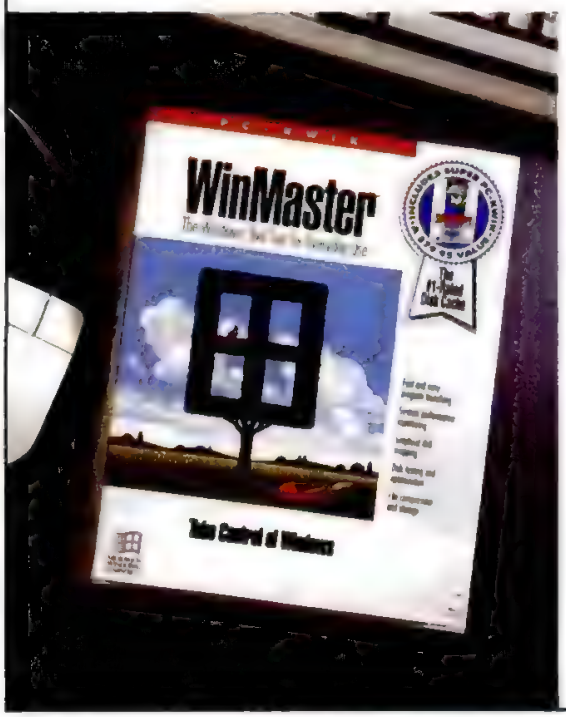

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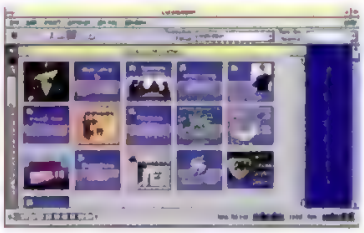

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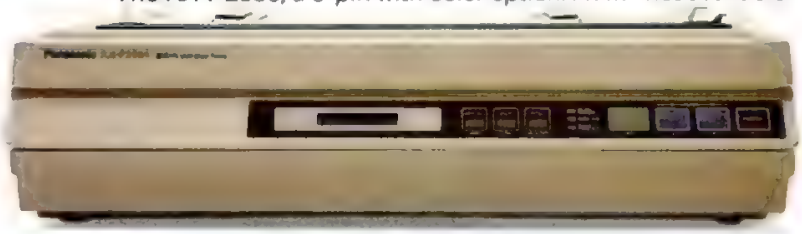

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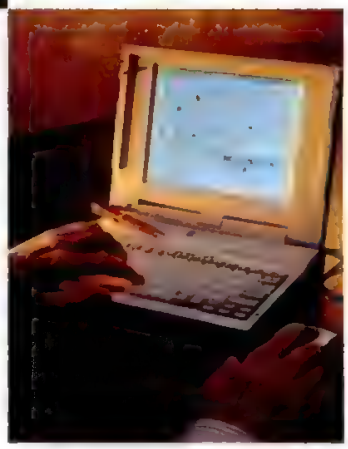

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CIRCLE 034 ON READER SERVICE CARD

Moore's Law vs. Machrone's Law

Rules of thumb help us understand and operate in an increasingly complex world. These laws of behavior are all around us and run the gamut from homespun homilies (a watched pot never boils) to scientific observation (red sky at night, sailor's delight). Moore's Law is in the realm of scientific observation. The law states that the number of transistors on a chip doubles every two years. Gordon Moore, who was one of the founders of Intel, postulated this rule back more than a decade ago, and it's held true since then.

Machrone's Law is more an economic model: The personal computer you want has always cost $5,000. I'm not talking about some cheapo thousand-buck 386SX; I'm talking about the top-of-the-line, all-out machine that you *really* want. This rule became obvious to me in 1988, and it has held up quite well in the intervening years.

Both laws have serious implications for the immediate future of the computer industry. While they were for several years independent of one another, there's a coming conflict.

You can confirm the accuracy of Moore's Law by looking at any chip vendor's press releases and product specifications on a historical basis. The devices double in complexity, halve themselves in size, or run at twice the speed roughly every two years. Various predictions about built-in walls that stop a given chip technology from going beyond a certain point have proven uniformly wrong. Of course, there are immutable laws of physics waiting for us at the end of the trail, but that's still a couple of orders of magnitude smaller and faster than present-day devices. Also, those limitations only apply to current semiconductor techniques. If engineers find simple ways to use light instead of electrons to move and manipulate the data inside a computer, it's a whole new ball game.

Machrone's Law also has history on its side. It all began well before the IBM PC was introduced, even before it was conceived. The first eight-bit personal computers, introduced way back in 1976 and 1977, cost about $5,000 once you got enough bits and pieces together to make them useful. I can remember buying a $695 16K memory card and having to solder it together and insert the chips myself. It would have cost $1,000 otherwise. The original IBM PC was a $5,000 machine by the time you added floppy disk drives, the monitor, and enough memory to run something besides ROM BASIC. The XT that replaced it a year and half later also cost $5,000. Prices had come down, but the CGA monitor and 10MB hard disk managed to push the delivered price right back up to five grand.

Then came the PC AT. That's right, at $5,000, complete with its 6-MHz 286, 512K RAM, 30MB hard disk, and exciting new EGA graphics board and monitor. Compaq was first on the market with a 386-based machine, and it cost—surprise!—$6,000. Prices quickly returned to the legal limit of $5,000 as other computer manufacturers figured out how to harness this fantastic new 16-MHz chip. Machines in the post-386 era have followed a dizzying spiral of faster processors, more memory, bigger disks, and better graphics. In each case the newest technology was introduced at the requisite $5,000 level.

The machine of your dreams has always cost $5,000. But how much longer can this go on?

In the past 18 months, however, the scene has turned ugly. Manufacturers began introducing machines at lower and lower price points, with higher and higher levels of technology, until today you can buy the flat-out state-of-the-art machine of your dreams for about $3,000. Does this mean that Machrone's Law is invalid? I think not. It simply means that we're overdue for a new generation of hardware. The next gener-

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CIRCLE 002 ON READER SERVICE CARD

ation is just around the corner, with local bus, half-gigabyte hard disks, tens of megabytes of RAM, and Intel's crowning glory, the P5 chip. Want to take a guess at what the price might be?

In the meantime, the price and feature wars have been very good for consumers, as shown by strong sales figures and overall growth in a down economy. They haven't been so good for computer manufacturers, however, despite overall increases in unit sales. Pressure on profits has become enormous as more and more manufacturers entered the fray, and they had to simultaneously learn to build the machines at less cost, while living on slimmer margins.

Some manufacturers have died trying, while others have had to reinvent themselves as companies in order to stay in the business. The simple truth is that there are too many manufacturers in the business, and their number will decrease as surely as the number of automobile manufacturers decreased, from the industry's one-time high of 200 companies to a much more sensible number.

THE FREE RIDE

Peripherals, meanwhile, are getting a huge lift from the computer manufacturers' plight. The tremendous bargains in desktop systems and the ever-higher levels of performance have created a huge market for monster hard disks, big multiscanning monitors, high-resolution printers, and a host of add-in cards to make the basic box even faster and more capable. Sure, you get a lot more memory and disk storage for your money these days, but the pressure on these manufacturers is nothing like the crushing body blows the system builders have had to take.

At the same time, printers and monitors can be the most expensive components of your system. They're likely to remain that way, too. Moore's Law applies to chips. It does not apply to CRTs and clunky, mechanical devices that move paper through rollers and over imaging drums. The extent to which your computer becomes a few pieces of highly integrated silicon is the extent to which its cost plummets. IBM/Lexmark made waves a few years back when they introduced a laser printer with a third fewer moving parts. Can they take out another third? Unlikely.

Ultimately, Moore's Law will obsolete Machrone's Law. But it won't be this year or next. □

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- *I/O Ports:* One serial, one parallel and two PCMCIA memory card connectors.
- Carrying case, cables and adapters included.
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- *Screen:* Easy-to-read 7" x 2¾", 640 x 200. 80 x 25 character display.
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Digital brightness and contrast buttons make screen adjustment so easy.

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2MB, 60MB Only $1895!

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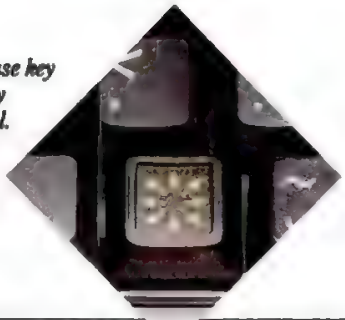

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CIRCLE 038 ON READER SERVICE CARD

John C. Dvorak

The Shallow Promise of Pens

1992 would be "The Year of the Pen," declared Jerry Purdy of Phoenix Technologies during a Comdex session on pen-based computing. Jean-Louis Gassée, writing in *MacWeek* on Sept. 10, 1991, boldly claimed, "Earlier this year, GO Corp. introduced its new pen-based operating system. Seldom has a new platform been received with such unanimous approval by developers, press, and pundits."

Apparently Gassée wasn't doing his research because naysayers such as Amy Wohl, Stuart Alsop, Will Zachmann, Bill Machrone, and myself all had serious doubts about the new technology. In fact, those who jumped on the pen-based computer bandwagon have discovered that there was no parade.

If you boil down all the arguments for pen-based computing, you discover four myths:

1. People are more comfortable with a pen and a pad then they are with a keyboard.
2. Executives will not use a keyboard because it tarnishes their image.
3. Notebook computers are unacceptable in meetings because of the keyboard clack.
4. Some applications are better suited to pen than keyboard.

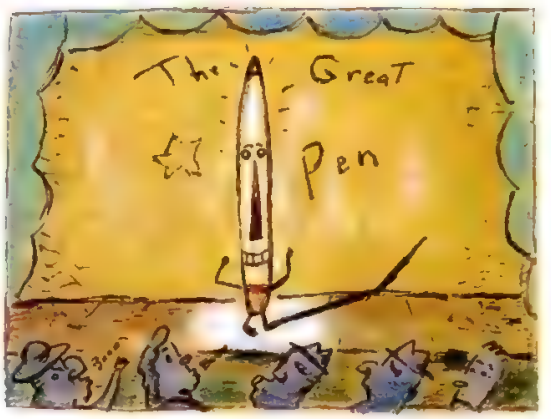
The first myth is the most controversial. People who learn to use a keyboard are far more comfortable with a keyboard than a pen. Though people do use notepads and like them, will they accept an expensive stylus computer as a substitute? Not when the pad and pen are far more convenient.

The second myth is more rear-view mirror thinking. The only executive who eschews a computer keyboard is the old-fashioned gruff bossy executive who demands to be called Mister. This joker is a dinosaur. Why are we designing a computer for him? And why would he use it?

The third myth is pure bunk. Today's laptop keyboards are quiet, and nobody cares about the minor clicking. Furthermore, anyone who has been to Japan, where notepad computers are more practical for ideograms, knows that the constant tapping of the stylus on the screen is every bit as annoying as any typing.

The final myth is more arguable. Yes, there may be some applications that benefit from a pen-based platform. These are mostly factory/field applications, where someone like the oft-cited bread truck driver or FedEx person can check off some boxes on a computerized sheet. Of course, FedEx has a specialized keyboard/bar code device that already does this and, as far as I can tell, the bread distribution business isn't suffering or inadequate. So who would use this thing? An insurance agent is the only candidate. This brings me to my real criticism of this technology and its hopeless boosters.

Ignoring the technological (handwriting recognition) and expense ($3,000 to $6,000 per machine) roadblocks, my concern is one of "vision." Even the wackos promoting virtual reality have a sincere vision of a world bettered by the technology. Most new technologies have this kind of idealism. The only force pushing pen computing is the vision of a quick buck. Its boosters are entrepreneurs hoping to make a killing and bored venture capitalists looking for a new scam.



So where's the pen parade? Nowhere, because the pen platform is based mostly on pure bunk.

The only groups to be served by pen-based computing are insurance agents, truck drivers, other disinterested technophobes, and dullards who think it's neat-o to have a 6-pound clipboard-size electronic Day-Timer in a leather case.

This whole scene is nonvisionary, boring, and pathetic. In a future world of desktop video, multimedia, virtual reality, and other whiz-bang technologies, pen-based computing is about as technologically inspiring as a new laundry detergent. Whether it works or not is beside the point.

Illustration by Andrew Shachat

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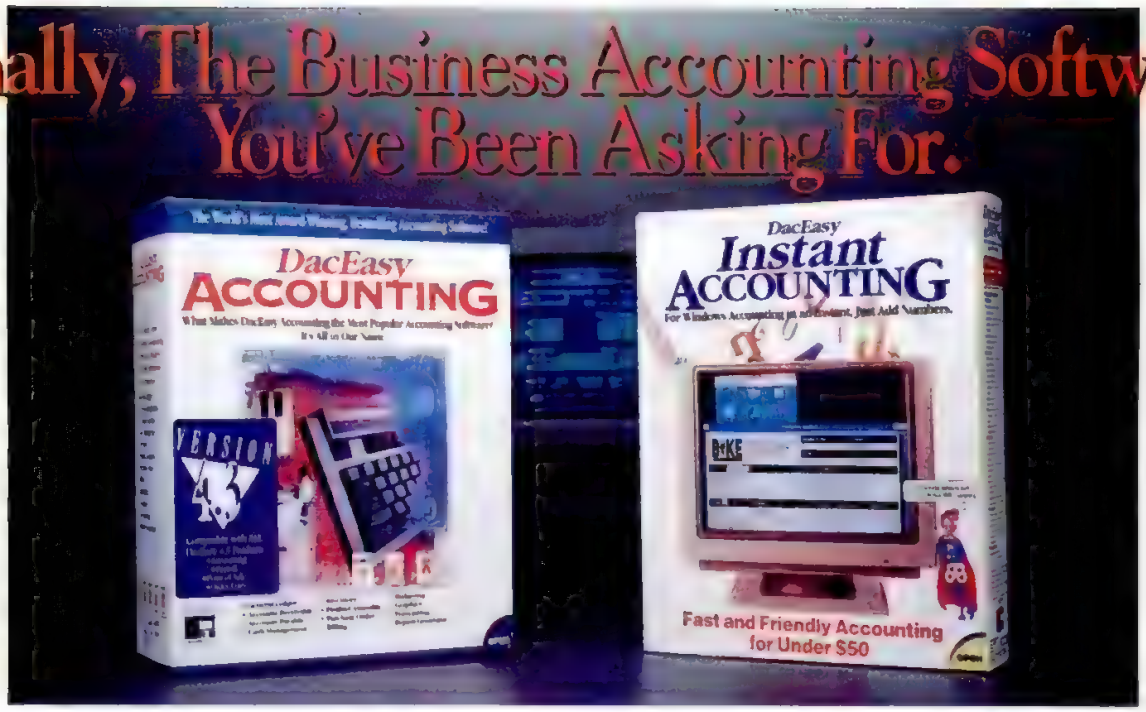

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CIRCLE 243 ON READER SERVICE CARD

John C. Dvorak

Inside Track

Seems Like A Scandal to Me Dept.: Here's a page for the **suppressed** stories of 1992 file. As far as I'm concerned, it's right up there with any scandal you can name. An excellent tabloid newspaper called *The CPA Software News* (published six times a year, $25/year, write 130 N. Broadway, #300, Shawnee, OK 74801; 405-275-3100) carefully evaluated the top 20 tax preparation packages. Creating a benchmark suite of numbers to be posted into the packages, it discovered that **no two of the 20 packages could arrive at the same tax owed.** What made it worse was that the tax owed varied from a low of $2,730 (SCS/Compute's LMS/Tax) to a high of $5,669 (CCH's 1040 Solutions). Other values calculated were $5,048 from the popular **TurboTax** from ChipSoft, a flat $4,500 from the **Prentice-Hall Software 1040,** and $4,115 from CPAid's Master Tax. This is not a couple of dollars difference. The difference between high and low is more than twice as much. The **discrepancies** stem from calculations made for capital gains, schedules C and E, and Form 4797. Given the same exact numbers, for example, the schedule E income loss calculation varied from a negative $228 (Tax Resources Ten40) to minus $10,997 (CCH's ProSystem fx).

The problem boils down to **complexities** in the tax code. So much is "open to interpretation" that no software package can be used for complex returns without the supervision of a knowledgeable CPA. When you talk to CPAs about the tax situation, they all say it's **out of control.** While the Tax Reform Act of 1986 helped Joe Six-Pak do quick returns, it made it more difficult for anyone with mixed incomes. I'm told that as of today **3 percent of the U.S. workforce** is somehow involved in **tax compliance.** The flat tax looks better and better every day.

As an aside, I like to point out that about 15 years ago I went to the University of California to become a certified tax preparer. I got my certificate and today I cannot do my own taxes. **It's impossible.** I use a CPA firm. And I'm no millionaire.

A suggestion to the IRS. Not wanting to encourage even more government involvement with everyday life, I do have to suggest that the IRS or a nationwide accountancy group **certify software** for use by individuals for the purposes of tax preparation. It would be even better if the U.S. Government used the expertise of the IRS's computer division (the guys who develop the program that flags people for audits) to **develop a public domain software system.** The discrepancies would be avoided using a government approved **expert system front end** to the tax software. What's the difficulty in doing this? It will force consistency and eliminate late reinterpretations and second-thought audits done because someone changed their mind. The situation with these tax software packages is unnacceptable.

The computer community is bug-eyed over Microsoft's getting into bed with CPU maker MIPS, but Intel is so dominant that I doubt any of this really matters to them.

And Now For Something Completely Different Dept.: The executives at **Microsoft** must be having **a good laugh** over the blood feud developing because of the personnel heist of Gene Wang from Borland to Symantec, especially after alleged intercepted MCI memos and **accusations** of all sorts **spewed** from Borland. They were all aimed at Symantec CEO Gordon Eubanks. Microsoft was bent out of shape when Borland took Rob Dickerson from them too, but not to this extent. **Borland essentially thumbed its nose** at Microsoft. Personally, I wish these companies would put more energy into debugging code.

Strategic Partners Dept.: The computer community is bug-eyed over Microsoft's **getting into bed** with CPU maker MIPS and its parent Silicon Graphics. Microsoft must **grow** and it sees the workstation arena as a growth opportunity. Windows NT is sometimes referred to as Windows RISC. Microsoft cannot obviously **penetrate the confines** of Sun Microsystems where UNIX rules supreme under UNIX guru Bill Joy, so Microsoft will trade its talents to Silicon Graphics and DEC in an effort to replace UNIX and VMS with Windows NT. In the process, there is supposedly a **cozy relationship** developing with MIPS in much the same way that one developed with Intel during the days of the 286, a chip whose design is believed to have been influenced by Microsoft. Whatever the case, MIPS is supposedly listening to Microsoft. This will make it easier for Microsoft to port Windows NT to the **future generations** of the MIPS chips. Meanwhile, Intel has become so dominant in the microprocessor world that I doubt if any of this matters to them.

Meanwhile, DOS 6.0 Looms Dept.: So where's the next iteration of **DR DOS?** As you recall, right after the first showing of DR DOS 5 in London, Microsoft quickly copied the features list and incorporated most of the features into DOS 5.0. Then came DR DOS 6 and Microsoft is following with MS-DOS 6.0 incorporating many of the features of DR DOS 6. The designers figure they'd wait until Microsoft rolls out DOS 6.0 before they even talk about DR DOS 7, which may be a **monumental** product. Maybe this time we'll see the true multitasking DOS! □

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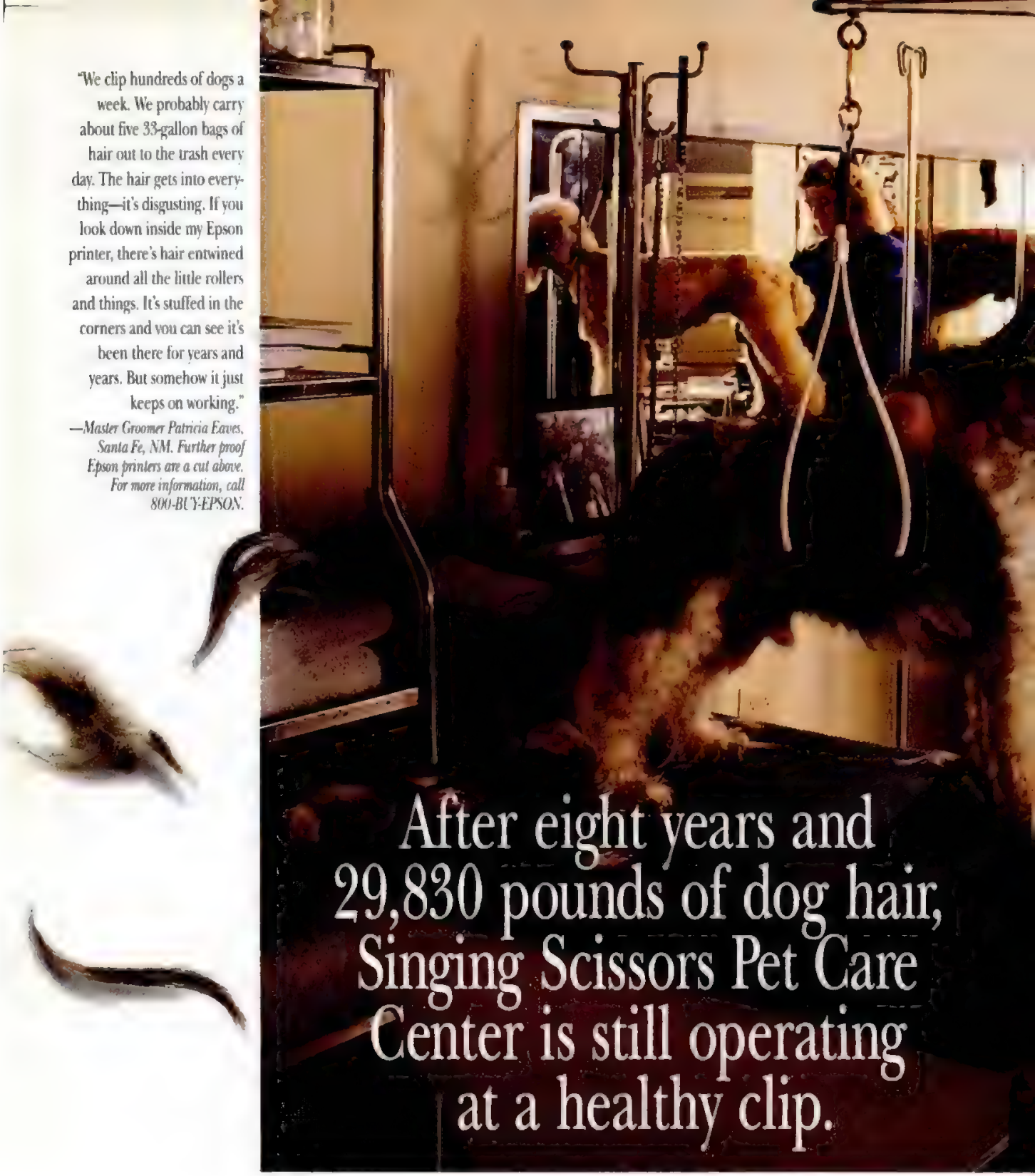

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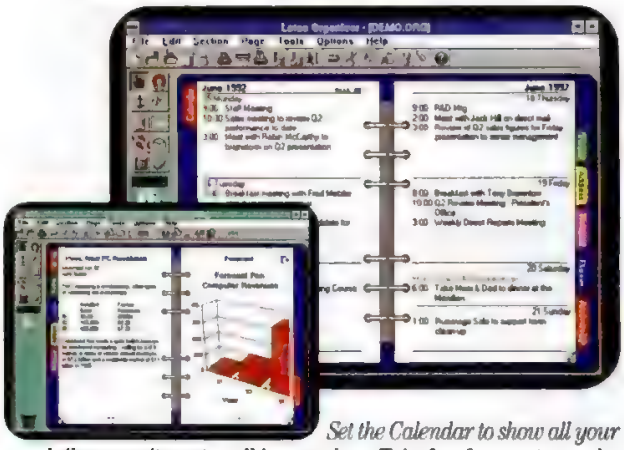

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Jim Seymour

How Bad a PC Can You Live With?

"C'mon, Jim." I'd been having this argument with my wife, Nora. It had been going on for a number of weeks. I kept telling her about the glories of the new subnotebooks, and she kept saying, "But they can't *do* anything!"

So I'd whip out a Zeos Pocket PC or a Hewlett-Packard 95LX, and show her how you could keep your schedule for weeks ahead. "But you don't use that," she'd say. "Your schedule is on your desktop PC, because you keep it in a Windows program that won't run on these little things. C'mon, Jim."

True enough.

So I'd pull out the Gateway 2000 HandBook and show her how its backlighting makes the screen visible in the worst light. And how a tiny modem can help me keep up with electronic mail when I'm on a trip.

"Great," she'd say. "A $1,300 e-mail checker. But you won't always carry one of those things when you travel. C'mon, Jim."

This was getting serious.

"Well, then look how thin and fast this Dell 320SLi is," I said. It was a desperate ploy. "I can run anything on this baby that I can run on the desktop machine. It has a real keyboard, a serious hard disk, and look at this big screen!"

She peered at the Dell's non backlit screen, tilted it back and forth, squinted, and finally said, "But you can't *see* anything! C'mon, Jim!"

I was just about at the end of my rope. "Well, if you're so picky, then how about this Texas Instruments TravelMate 4000?" I flipped on the machine, its hard disk whirred, and the bright, backlit screen came to life. Windows appeared. My StartUp Group popped one app after another into place on the screen.

"See? Good keyboard, great display, big hard disk, lots of memory, a 486 chip. . . ." I could see from the look in her eyes that I'd finally won.

"You're right," she said. "Now *this* is a real computer. You can just leave this one with me for a while."

It was a hollow victory. I'd been trying to persuade her of the virtues of small, light machines as road companions, but she went for the notebook equivalent of big iron: a 1.8- by 11- by 8.5-inch, 5.7-pound giant, compared with tiny wonders like the Zeos.

Worst of all: She was *right*.

For about a year and a half I've been trying to persuade myself that one of the new subnotebooks is the right road machine for me. I'm *reasonable* about this: I don't expect it to fit into my jacket pocket, replace my desktop PC, or run presentations in color. I just want a smallish machine to take along when I'm pretty sure I won't be doing any big-time computing, but I want to be able to write, take notes, check my schedule, look up names and addresses in a database, and so on. And run a few of the other programs I use.

In the end, for me the choice comes down to the five machines I showed my wife. They span the range from nearly pocketable to a full-fledged, power user's notebook.

I fell on the HP 95LX with glee, for example, but quickly discovered it was just too feeble for my needs. The keyboard's too small, it's too hard to get software into the machine, the 7.5-inch display is hopeless, and having Lotus 1-2-3 on-board isn't much of an advantage for me.

In the quest for the lightest notebook, you have to ask: "But can I use this thing?"

The Zeos Pocket PC has a wonderful form factor: wide, shallow front-to-back, thin, and less than a pound and a half. It lasts about 10 hours on two AA cells. But while it will run DOS apps you load onto cards inserted into one of its two PCMCIA slots, the display is small and dim, the character set is cramped, and the machine's 8088 processor is slow. It doesn't have a

Illustration by Andrew Shachat

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CIRCLE 008 ON READER SERVICE CARD

hard disk, so you have to use one of those PCMCIA slots to store your data.

The Gateway HandBook is thicker, deeper, and twice as heavy as the Zeos machine. But in return you get a backlit screen (double-scan CGA), a Chips & Technologies chip set that approximates a middling-fast 286, and a hard disk.

I like the HandBook. I don't much like the built-in Microsoft Works package, but if you can make the built-in LapLink XL talk to the version of LapLink on your desktop or other machine—a challenge—you can load any DOS apps you want onto the HandBook's hard disk. The keyboard is decent despite some weirdly relocated keys, and the display, though small, is readable.

That leaves the Dell 320SLi and the TI TravelMate. The Dell is a crossover, lighter and smaller than the typical notebook, but with all the power and features of those machines, save one. The missing element is critical: The 320 SLi's screen is not backlit.

How important is that? Well, Dell gets credit for the very best non backlit display I've ever seen. But in anything less than good room light, it's still hard to see. In every other way, the Dell is the winner: It's the very best ultra lightweight notebook PC I've used.

Similarly, the TI TravelMate is among the best of the full-size power notebooks. It's fast and capable but weighs almost 6 pounds.

In the end, the choice of a traveling machine comes down to a simple if perverse question: How bad a computer are you willing to take on the road? For me, the threshold of pain turned out to be right below the HandBook. Less than that I can't live with: "C'mon, Jim. They can't *do* anything!" rings in my ears.

That still leaves three interesting machines. Is the HandBook really enough? Can I live without Windows when I'm on the road? Is the Dell's display good enough—and is the machine too heavy, in any case? Do I want, in the end, to give up and fall back to the TI or another desktop-level PC for traveling? And—dare I make this even worse?—what about color? As I've come to rely on Windows, I've come to rely on color, too. Can I live without either?

I'm going to be living with one or another of these three PCs—and another one or two that haven't yet been officially announced—for the next few months. I'll get back to you with my further thoughts. □

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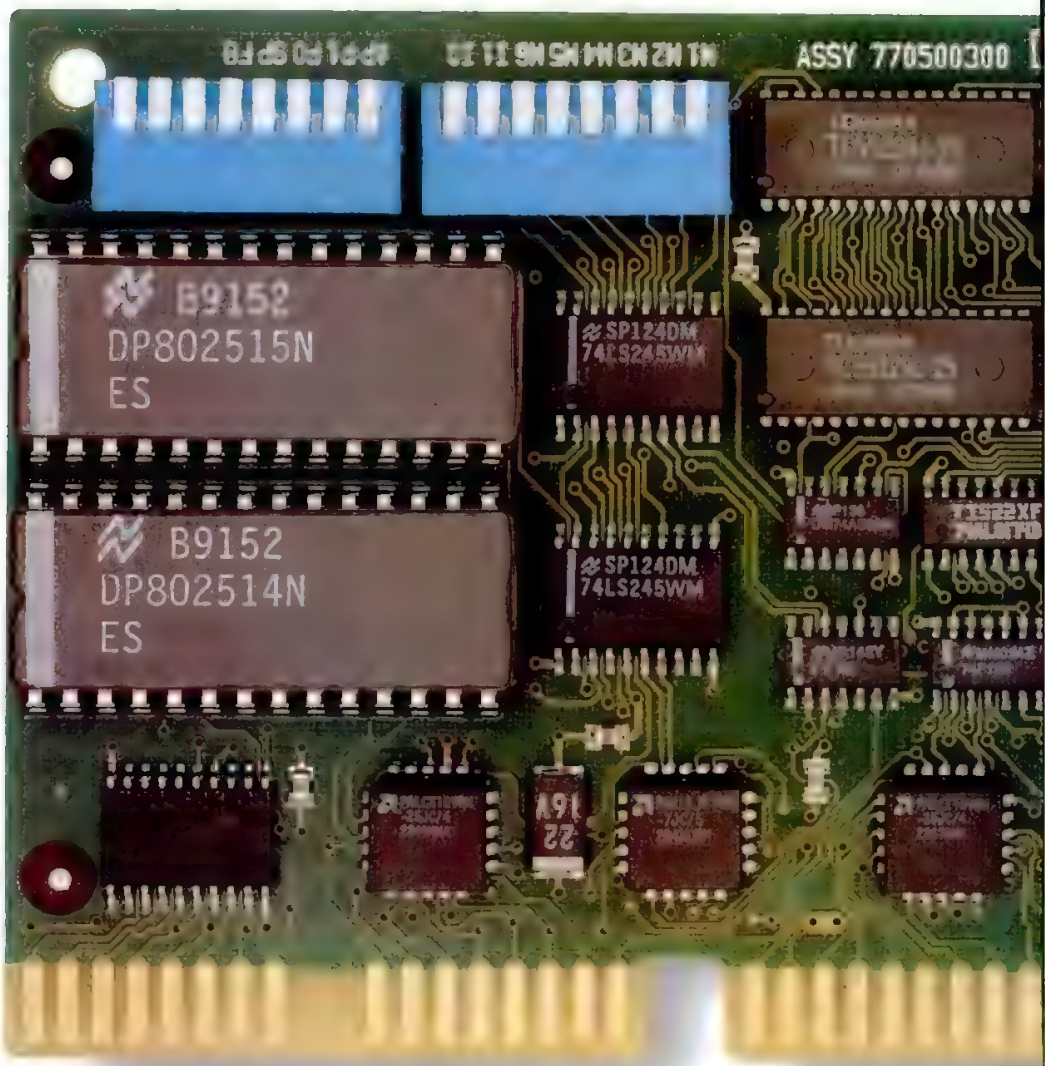

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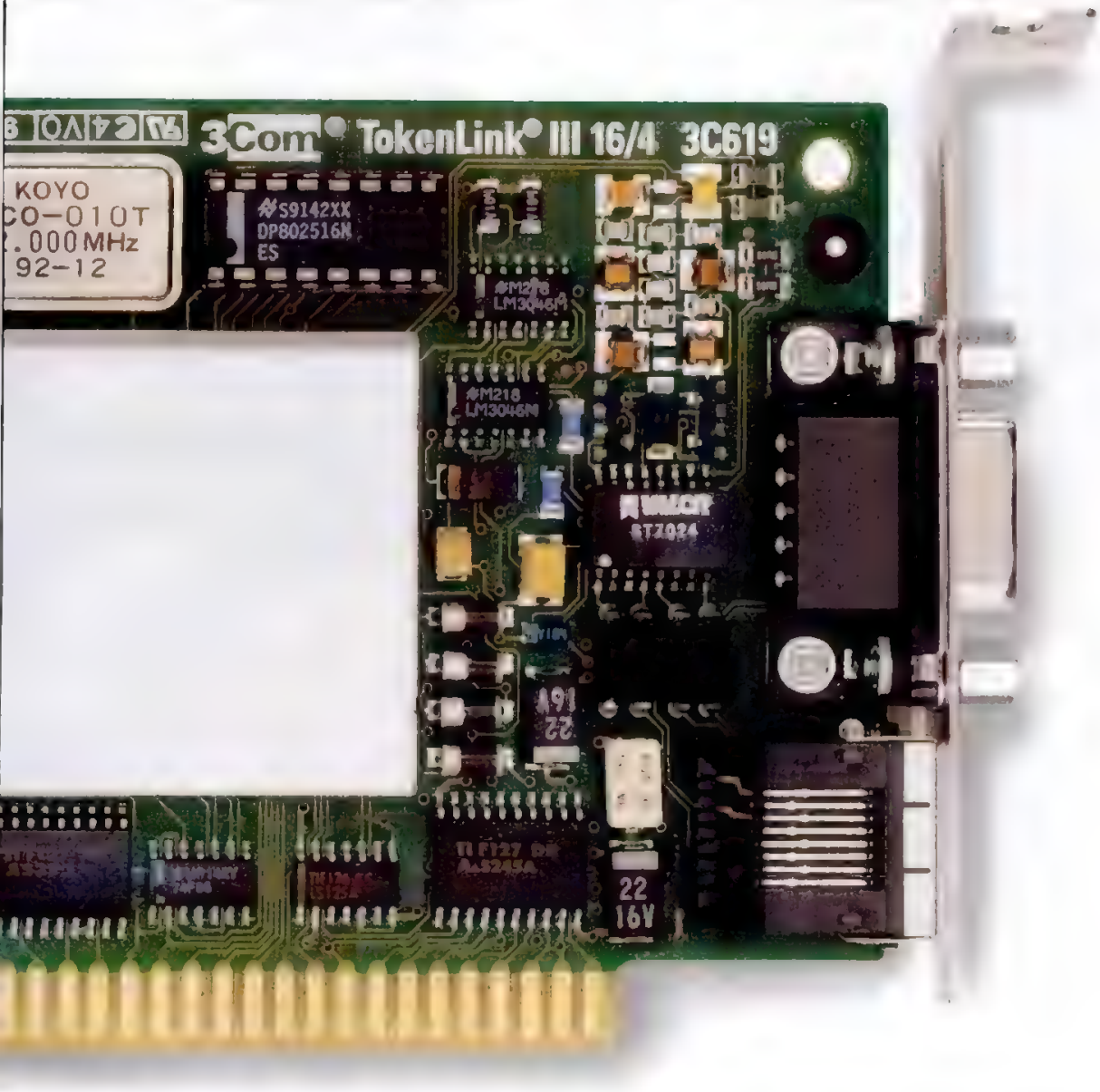

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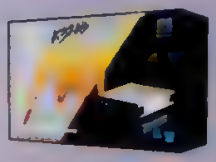

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William F. Zachmann

An Operating System For The '90s

DOS is doomed. The 16-bit barely-an-operating-system that began its life as PC-DOS for the IBM Personal Computer in 1981 and dominated 80*x*86 architecture PCs for more than a decade will not survive the 1990s.

The crucial question is: What will replace DOS? Which 32-bit operating systems vying for DOS's crown will ultimately gain the upper hand? Who will win the battle among OS/2, Windows NT, Unix, and others?

The current conventional wisdom, aggressively encouraged by Microsoft, holds that Windows 3.*x*'s present success is already sufficient to decide the matter in favor of 32-bit Windows. "The battle for the desktop is over," Microsoft and its supporters like to say, "and Windows has won."

It hasn't, though. Windows copies actively in use are far below Microsoft's claimed shipment numbers. Many software vendors say they have been disappointed with their Windows application sales. Windows penetration of the active installed base of *x*86 systems, from 8086s to 486s, remains below 10 percent. Windows 3.1, while an improvement over 3.0, still suffers from instabilities and limitations inherent in its DOS foundation.

Windows NT is the biggest problem, though. Microsoft promised to ship a truly 32-bit, fully preemptive, multitasking, multithreaded version of Windows that is the first to implement the Win32 API (application programming interface) by the end of 1992. But Windows NT will likely require at least another year or two before it supports the Win32 API efficiently on *x*86 systems. Even then, it will be missing too many of the capabilities Microsoft promised.

There is no question, for example, that NT's resource requirements will make OS/2 look lean and mean by comparison. NT's stated 8MB memory requirement, for example, looks like a bare minimum, at best.

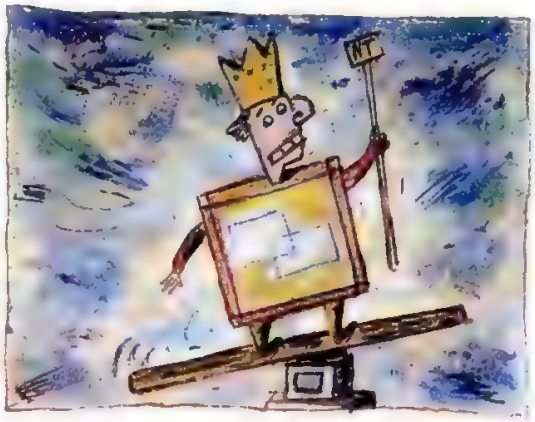
At the same time, the complete DOS- and 16-bit Windows compatibility Microsoft originally promised for NT has somehow turned into only a goal for top DOS and Windows applications. NT may very well suffer the same problems of OS/2 1.*x*'s infamous DOS "penalty box."

Microsoft will also have problems establishing broad device-driver and hardware support, similar to those suffered by early versions of OS/2.

Meanwhile, IBM is finally putting the remaining pieces of OS/2 in place. It will feature support for high-resolution graphics, Windows 3.1 applications, and a wider range of device drivers. It will also operate more efficiently and have lower resource requirements than the current version. Better networking capabilities now make OS/2 a much stronger option for corporate users.

Key secondary support for OS/2 is also falling into place. There's a large and growing list of software vendors who are actually shipping 32-bit applications. Application development tools, too, are rapidly becoming available. There are also some excellent books on OS/2 use and programming. One of my favorites is Harvey Deital and Michael Kogan's *The Design of OS/2*.

IBM's initial problems with OS/2 2.0 distribution and support are being solved. Distributors like Merisel and Ingram Micro are now selling OS/2, and IBM has broadened its 800-number support, for example.



The success of Windows NT over OS/2 in the 32-bit operating system world is anything but assured.

The growing strengths of OS/2 and the increasingly obvious problems of Windows NT should make one consider whether the conventional wisdom about Windows' assured dominance is correct. My own view is that it is not.

OS/2 2.0 provides today the powerful desktop operating system that Microsoft still can only promise for the future. As that fact becomes more obvious to more users, the shift from Windows to OS/2 that has already begun on a small scale will gather momentum. □

Illustration by Andrew Shachat

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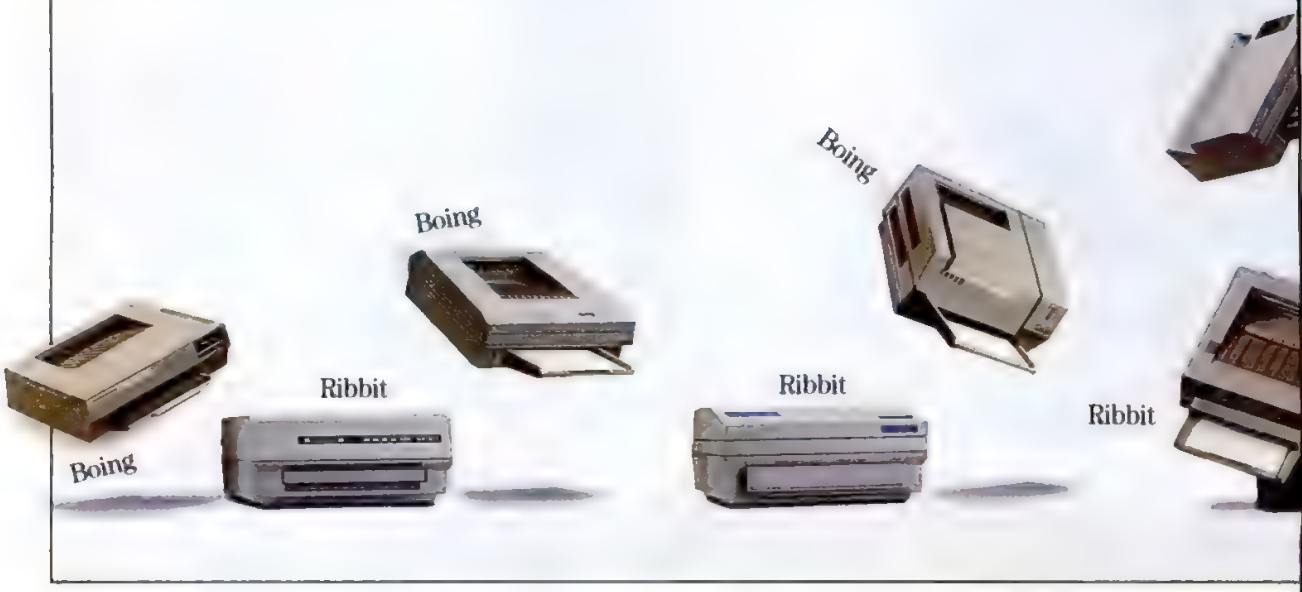

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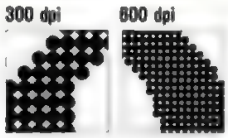

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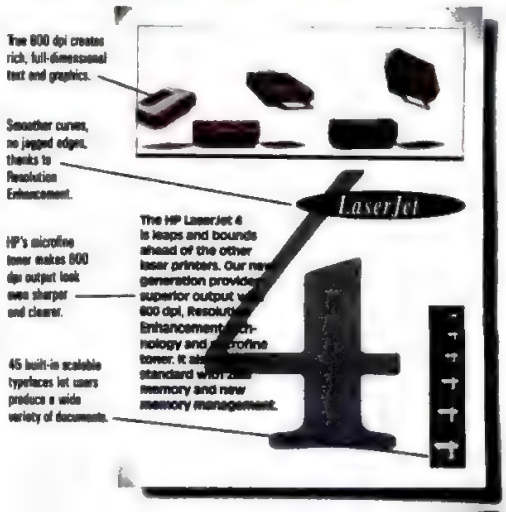

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Several popular software drivers are included: Windows, WordPerfect and Lotus. As well as the new HP Explorer PC utility software, which provides a printing tutorial to guide your users through set-up and operation of the printer's new features.

All this makes the HP LaserJet 4 printer supremely simple to plug-and-play. As you'd expect, it also offers complete document and software compatibility with the HP LaserJet III printer.

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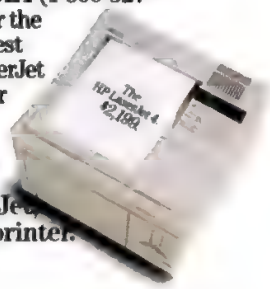

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9th Annual Printer Issue

Photographs by Scott Wippermann

Lower prices, higher resolution and better print quality, increased choices for network users, more variety for everyone, and a nod to the environment. That's the outlook for *PC Magazine*'s ninth annual printer review. This year, we rolled up our sleeves and put 100 new models to the test.

by Bill Howard

Hewlett-Packard raised the bar to 600-dot-per-inch resolution with the October release of the $2,199 HP LaserJet 4 and the $2,999 HP LaserJet 4M.

Buyers of dot matrix printers continued a trend that began last year, when 24-pin models outsold 9-pin units for the first time.

The same competitive frenzy that's driving 486 PC prices down toward $1,000 will give us, within the next year, the first sub-$500 laser printer and first sub-$100 dot matrix printer (street prices).

Shared printers with engine speeds of at least 12 pages per minute (ppm) are proliferating because it's cheaper to link 15 users to one high-speed laser printer than to hook the same users to 15 cheap laser and dot matrix printers.

We're also seeing more variety in printers this year: multiple bins, duplexing, resolution and halftone enhancement, scalable fonts, and 11- by 17-inch output.

Kyocera unveiled a laser printer that knocks the cost per page to less than a penny and has only one throwaway part, a biodegradable container for the toner powder.

Here are more details on the state of the printer market as we head into 1993.

LASER PRINTERS

While their new features represent a technical tour de force, the HP LaserJet 4 and HP LaserJet 4M are in some ways catch-up products. Small footprints, multiple paper bins, and resolutions of 600 dots per inch (dpi) were all available last year in 8- to 10-ppm printers from other vendors.

Still, Hewlett-Packard is Hewlett-Packard, and the HP LaserJet 4 and 4M have all the earmarks of being the printers to beat for 1993. For one thing, HP's 600-dpi resolution is available for PCL graphics, as well as text. HP PCL 5 does not support graphics printing above 300 dpi, but the HP printers boast an enhanced version of PCL 5. HP has also expanded its standard internal scalable fonts to include the two basic TrueType families, Arial (Helvetica-like) and Times New Roman, making these especially capable Windows printers.

The Paper Chase: *Finding the Right Paper for Your Needs*

by Susan G. Thomas

Funny, in this electronic age there are more types of papers to choose from than ever before. Environmentalists have pushed paper mills into producing more recycled papers. Many Fortune 500 companies are now opting for distinctive paper, rather than catchy logos, to give their own stamp to corporate letterhead and reports. Many paper mills, paper designers, and even printing companies are marketing their own "laser-compatible" and "printer-safe" papers. We surveyed the paper options at large and report our findings here.

Textured papers—recycled or not—can be an eye-catching alternative to a snappy logo or graphic on corporate stationery.

LASER-COMPATIBLE PAPERS

Many paper mills and paper designers, such as Cross Pointe Paper Corp., The French Paper Co., Hammermill Papers, Weyerhaeuser Co., and others, now market what are labeled "laser-compatible" papers. Basically, that means *smooth*. Some recycled or handmade papers have a finish that is too coarse and pulpy to work effectively in laser printers: They may splinter or flake—particularly the short, brittle fibers of recycled papers—causing a dust build-up on laser printer drums. Laser-compatible papers will glide through your laser printer's path without shedding.

While it's important to avoid gunking up your printer, you don't have to restrict your paper choices to those that claim laser compatibility. For normal business correspondence, just make sure that the paper has a clean, smooth finish.

You may find, however, that handmade and recycled papers (even smooth ones) do not hold toner well. A laser printer's heating process is sometimes not intense enough for very thick sheets (as in the case of many handmade papers) or pages with weak surfaces (sometimes a characteristic of recycled papers). If you notice that your output smears after printing, hold a hair dryer over the paper to heat-seal the toner onto the surface.

If you want to print on a more-exotic, handmade paper, by all means try it; you almost certainly will not destroy your printer, and the effect may be dazzling. One good source of attractive handmade papers is Magnolia Editions of Oakland, California.

In case your experiment is a shaggy failure, some companies carry cleaning sheets for laser printers. For instance, PaperDirect (800-272-7377) offers a LaserKleen paper, which runs through a manual feed and picks up dust and toner deposits.

For normal laser printing, do not try feeding paper that is over 67 pounds. (None of the laser printers reviewed in this issue has a rated maximum paper weight over 45 pounds.) Stock that is heavier than 67 pounds is too stiff to make the journey through the paper path of most laser printers.

RECYCLED PAPER

If you're attracted to the environmental benefits of using recycled papers, choosing your paper may be difficult. First of all, paper is never 100 percent recycled material. If you tried to create a sheet that was composed entirely of recycled paper, you would end up

with a handful of dust; the cellulose fibers that make up paper are too short and thus too weak to hold together. Paper mills generally add about one-third virgin fibers to their recycled pulps.

The Environmental Protection Agency is vague in regulating what paper mills must put into the other two-thirds of the concoction. EPA guidelines for recycled papers require at least 50 percent recycled paper pulp—but that 50 percent can be either postconsumer (the paper you've thrown into your recycling bin) or preconsumer (any fibers that fall on the floor of the mill during the production process). Ask paper mill representatives about their policies and order a paper that you feel is truly environmentally sound. Also look for a smooth finish, especially if you use a laser printer.

TACTILE DESIGNS

Apart from the environmental aspect, some recycled papers tend to have interesting textures. And textured papers—recycled or not—can be an eye-catching alternative to the snappy logo or graphic on almost every form of corporate stationery.

Charles S. Anderson Design Co. of Minneapolis designed the Dur-O-Tone line of recycled papers with a texturized look for The French Paper Co. While the papers are acid-free and smooth enough to be laser-compatible, they have the rough-and-tough look of grainy newsprint, pulpy butchers' wrapping, and construction paper—chic alternatives to standard cotton bond.

Lasercraft, in Santa Rosa, California, designs papers with official logos or graphics stenciled in via laser beam (yielding a cleaner cut) for companies like Anheuser-Busch, AT&T, and Philip Morris. A dramatic alternative to embossed papers, Lasercraft papers can be designed for just about any paper stock (including wood and laser-compatible papers), and they are cut to avoid laser snags.

These LaserJets also have high-speed parallel ports (with a continuous transfer speed of 156 kilobytes per second) that can send status messages back to the PC, though this bidirectional communications ability is not yet widely supported by PCs or software. Expect to see at least a dozen printers released in 1993 based on the same 8-ppm Canon P-270 engine, which produces true 600-dpi resolution. (Many of the greater-than-300-dpi printers of the past two years got there by tweaking 300-dpi engines beyond their rated resolution.)

A bigger concern for HP—if you can say that a company with 55 percent of the laser printer market has concerns—is that the 7- to 11-ppm midrange is the weakest segment of the laser printer market. The 4- to 6-ppm market now outsells the midrange, and the networkable segment ("shared laser printers", with 12 ppm and up) has the highest growth rate.

At the lower end, where HP has been less competitive (even with the HP LaserJet IIP Plus), buyers don't mind trading engine speed for several hundred dollars in savings. Epson, Okidata, and Panasonic should pick up substantial market share with 4- to 6-ppm models list-priced around $1,000 that will move through superstores, warehouse clubs, and other nontraditional channels. For vendors, these new channels are a double-edged sword because of their liberal return policies. Buyers who are unsure of what they want and sellers loathe to turn down anyone waving a credit card have combined to push return rates to 15 to 25 percent for PCs sold through these channels, and there's little reason to expect that the situation for printers is going to be any different.

SPECIAL FEATURES ABOUND

Some features available only on a handful of laser printers last year have become more commonplace this year: resolution-enhancement offshoots of HP's pioneer RET (Resolution Enhancement Technology), standard or optional second bins, RISC coprocessors to speed up graphics printing, and scalable fonts (Adobe PostScript Level 1 or Level 2, PostScript clones, Intellifont, or TrueType). A few more printers have duplexing capabilities this year; their vendors include it either as a standard feature or as an option you can add to the basic unit, not as a feature of a separate model.

Laser printers that handle B-size paper (ledger or 11- by 17-inch paper) are also increasing in number—and they're getting cheaper. For this issue, we reviewed B-size laser printers from Compaq, Dataproducts, LaserMaster, and NewGen. The units from Compaq and Dataproducts ranged from a little over $3,300 to just under $6,000. The $4,595 QMS-PS 860 Print System will be the first B-size printer based on the 8-ppm Canon LBP-BX engine. Unfortunately, the QMS 860 just missed our deadlines, as did the B-size $3,995 CalComp CCL 600 (the first printer to use Intel's new 82961KD chip).

Kyocera introduced a technically excellent laser printer: Its $2,395 Ecosys a-Si FS-1500A is based on a self-polishing amorphous silicon photoconductor drum that lasts the life of the printer.

In the simplest terms, Kyocera grinds up ceramic material and fuses them to the toner polymers; the ceramic dust gently polishes the drum with each print. That means fewer used-up photoconductor drums are added to the waste stream. It also means that your cost drops from 2 or 3 cents per copy to 1 cent per copy (plus an additional penny for the paper, in each case).

The LaserMaster WinPrinter 400 has been upgraded to the WinPrinter 800; both units are "Windows printers" that

Our Contributors: BILL HOWARD is an executive editor of *PC Magazine*. MARY KATHLEEN FLYNN and JENNIFER ZAINO are associate editors, ANGELA GUNN and CATHERINE KUNKEMUELLER are staff editors, and SUSAN G. THOMAS is an editorial researcher at *PC Magazine*. MICHAEL J. ZULICH is a project leader at PC Magazine Labs. BRUCE BROWN, MITT JONES, EDWARD MENDELSON, ALFRED POOR, WINN L. ROSCH, and M. DAVID STONE are contributing editors, and JAIME LEVINE is the senior research manager at *PC Magazine*.

JOSEPH DESPOSITO, CAROL ELLISON, HENRY FERSKO-WEISS, GREG PASTRICK, and JOHN R. QUAIN are frequent contributors to *PC Magazine*. ROBERT ANTHONY is the editor of Stadium Circle Features. DON STEINBERG is a free-lance writer.

How We Tested the Printers

by Jennifer Zaino and Michael J. Zulich

PC Magazine's annual printer issue enters its ninth year with some important changes. You can't help but notice them, because they revolve around one of the foundations of this issue: our test-bed.

This year, contributing editor and former PC Magazine Labs project leader Bill O'Brien—who has been involved with testing printers for this annual issue since its beginnings in 1984—has enhanced our traditional Graphics Speed test so that it will better accommodate today's faster, more capable printers. The Text Speed test is only slightly revised (in a way that will affect performance to a very small degree, mostly in PCL and PostScript modes). We have kept it nearly identical to the old version so that the results will be comparable with those of the previous eight years of printer tests.

The Text Speed test still outputs the same two-page "Arthur D. Author" business letter that we've used since 1984. For dot matrix and ink jet printers, we print this letter twice in draft and twice in quality mode, then average the scores for each mode. For line printer emulators, performance in wide-carriage draft mode is particularly pertinent; therefore, we provide draft-mode Text Speed test results for these systems in both narrow- and wide-carriage operation.

For page printers, we print the Arthur D. Author test file ten times and then average the scores. Printing the file ten times helps to minimize the significance of the delay that you typically get with page printers when printing the first page.

Because of the nature of thermal wax transfer, solid ink, and dye sublimation color PostScript printers, we decided not to run the Text Speed test on these devices this year. Few users are going to buy a high-end color PostScript printer simply to output text-only documents. The Graphics Speed test better reflects the environment where these products will be making their homes.

Our Graphics Speed test has been significantly enhanced. In its current form, the test measures the time required to send and print two copies of a graphics image file created using CorelDRAW and Microsoft Windows 3.1; previously, the image was created using PageMaker and Windows. Among the other changes: The new

How to Read the Printer Guides

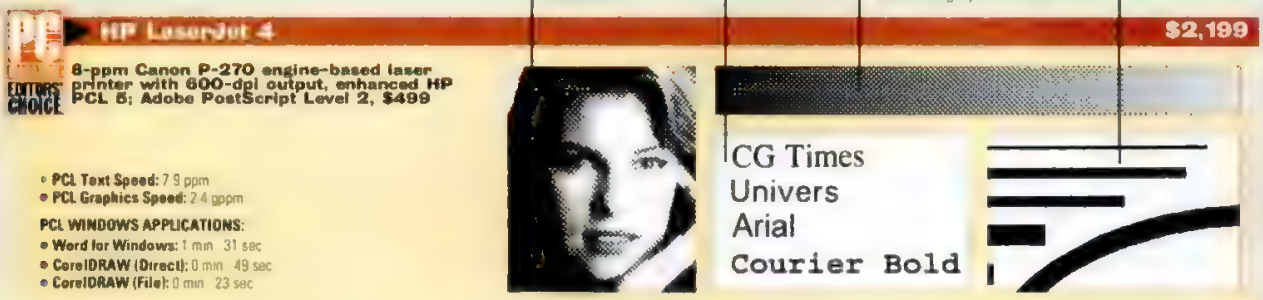
Text Speed
Our standard Text Speed test is a two-page business letter. The results for dot matrix and ink jet printers are reported in characters per second (cps), for page printers (laser and LED array units) in pages per minute (ppm), and for line printer emulators in lines per minute (lpm)

Graphics output
The photo shows how well the printer reproduces halftones

Text output
This provides a sample of each printer's fonts

Gray-scale or color output
This bar consists of six shades of gray for monochrome printers. For color PostScript and ink jet printers, the bar displays six shades of gray and six colors

Line art
This shows how well the printers handle lines of increasingly large pixel widths, as well as curves



Graphics Speed
The scanned photo doubles as both an output sample and a part of our Graphics Speed test. The results for all printers are in graphics pages per minute (gppm)

Word for Windows
The Word for Windows test uses a two-page business report for dot matrix and ink jet printers and a ten-page business report for page printers; these reports use multiple fonts and type styles. We report the results in the same units we used for the Text Speed test

CorelDRAW (Direct Print)
This Windows application test involves a direct print from within CorelDRAW. The same graphics file we used for the Graphics Speed test is used here. The results for all printers are in graphics pages per minute (gppm)

CorelDRAW (Print from file)
This version of the CorelDRAW test prints a pregenerated file external to the application. Again, the same graphics file used for the Graphics Speed test is used, and the results for all printers are in gppm

Graphics Speed test file uses a different scanned image that better displays how the printer reproduces halftones. The test now incorporates a 1-pixel-wide rosette and 1-pixel-wide polygon, which help exercise printers' RISC processors better than before. Because of these new elements—all of which affect performance to some degree—you should not compare this year's Graphics Speed test results against those of printers reviewed in previous years.

In every case, we conducted our tests via a printer's parallel or serial port. As the test-bed for this scenario, we used a Compaq Deskpro 386/25e running Compaq DOS 5.0, with 8MB of RAM and a 310MB ESDI hard disk. In the shared lasers section of this issue, however, you will also find results for performance via a network interface card (if the printer vendor provided one for evaluation). Our test-bed for the network tests was an Ethernet network and a 486/33 Compaq Systempro running NetWare 3.11; the Systempro had 16MB of memory and a 675MB hard disk. In general, you'll see slower results over the network; this is expected because of the overhead the network generates.

These DOS-level tests provide a good indication of the raw speed you can expect. Since these tests print directly to the parallel or serial port using the printer's resident fonts, factors such as downloadable fonts or software drivers do not come into play.

WINDOWS ON THE WORLD

Entirely new this year is PC Labs' battery of Windows 3.1 application tests, using Word for Windows 2.0 and CorelDRAW 2.1. Here, downloadable fonts and recommended Windows drivers do come into play. We present these tests to provide an indication of the printers' performance in some real-world situations.

For these tests, we reset very few Windows defaults: We set up a 19.256MB permanent virtual memory file and a 2K SmartDrive, and we turned off the Windows Print Spooler. We employed the Windows driver suggested by the printer manufacturer (in many cases, the driver was specific to the printer we tested). Keep in mind that the drivers play an important part in the results these tests generate. A printer that provides excellent raw printing speeds on our DOS-level tests may not do as well on our Windows tests—and the main culprit may be a poorly implemented Windows driver. Since vendors generally frequently update their drivers, performance could improve with the next driver release.

The Word for Windows test prints a two-page report for character printers (dot matrix printers, ink jet models, and line emulators) and a ten-page report for page printers. (We do not run this test on the color PostScript printers for the same reason we do not run the Text Speed test on them.) The report uses Windows 3.1 TrueType fonts—Arial and Times New Roman—in sizes varying from 8 to 14 points. The report also uses boldface, underscores, and italics. We time the process of printing this report from the moment we select File/Print/OK to the moment the last page is ejected from the printer. For impact printers, this test is performed in quality mode.

The CorelDRAW test uses the same file we use for our Graphics Speed test. The Direct Print version of this test prints directly from within the application; we time the process from the moment we select File/Print/OK until the page ejects from the printer. The Print from File version of the CorelDRAW test involves printing the test file to disk, then copying the file to the printer port; we time the process from the moment we press the Enter key until the page is ejected from the printer.

We tested each dot matrix printer in both Epson and IBM emulations (when available), but in each case we publish only the best score. (In most cases, the difference between the two emulations is small enough to be insignificant.) We do the same for ink jet printers that offer those emulations; this year, however, many of the ink jet printers provide only HP DeskJet emulation, so we tested them in that mode. For page printers that offer PCL and PostScript compatibility, we report the results in both modes.

If a printer was unable to complete any speed test, it receives an N/A ("not applicable") for that test in the performance test charts and the Printer Guides.

OUTPUT QUALITY AND COMPATIBILITY

Some of the images we use on our Graphics Speed test can be found in the Printer Guides. This year, we have replaced the scanned image of Trends editor Mary Kathleen Flynn with a new image that better showcases each printer's ability to produce shadows, highlights, and other details. The new photograph that was the basis for this scanned image was taken by Thom O'Connor, who has photographed all the printers for every issue over the past six years. The Printer Guides also include output that highlights a device's ability to produce gray scales and (for the color PostScript and color ink jet units) color.

Speaking of color, this year marks the first time *PC Magazine* includes objective tests that evaluate the range and color purity of the output from color PostScript printers. You can find detailed information on how we conducted these tests in the "How We Tested" section in "Color PostScript: Edging Toward the Mainstream."

Finally, this issue sees the annual return of our HP PCL 4 and HP PCL 5 Torture Tests, written by contributing editor Alfred Poor. These are joined by our new PostScript Level 2 Compatibility Test. This test, which was provided to us by Adobe Systems, uses a compression algorithm that is only available in PostScript Level 2. As you'll see, we certainly have good reason to include such a test this year: The inclusion of Adobe PostScript Level 2 is just one of the trends you'll observe among this year's batch of 100 new or significantly improved printers. Read on to learn about the rest. □

rely on the host PC for their smarts. In another Windows-related development, Microsoft was expected to bring out a cartridge this past summer that would give the new HP LaserJets support for Windows GDI (Graphics Device Interface) calls, but at press time we hadn't yet seen it.

INK JET PRINTERS

Ink jet printers have become in many ways a low-end extension of the laser printer market. BIS Strategic Decisions (a research firm in Norwell, Massachusetts) estimates that by 1996 ink jet printers will have more sales than either dot matrix or laser printers. At present, HP continues to hold a 55 percent market share through aggressive pricing (street prices of the $599 HP DeskJet 500 are $350 to $400), although competitors using Canon-supplied engines may cut into the lead.

Color currently is a niche, but as the price premium drops from 50 percent to 20 or 25 percent more than monochrome ink jets, color might account for as much as a quarter of all ink jet sales. Another speciality area is the large-format ink jet printer aimed at architects and power-spreadsheet jocks. For instance, the $1,499 Pacific Data Products ProTracer, which shipped too late for inclusion in this issue, produces C-size (17- by 22-inch) output.

COLOR POSTSCRIPT PRINTERS

The newcomer to this niche market (with sales of well under 100,000 units annually) is the PostScript-compatible high-quality dye sublimation printer, which is capable of near-photographic-quality output.

Tektronix is the price/performance leader here, with its $9,995 Tektronix Phaser IIsd. Quality is high, and as with all the dye sublimation printers, so is the operating cost (about $3 to $4 a page). For business presenters, thermal wax transfer devices are cheaper alternatives. Solid ink printers are less expensive in page costs but currently not that much cheaper than dye sublimation printers in initial cost.

DOT MATRIX PRINTERS

The dot matrix printer market may be in decline, but it still amounts to 4.9 million units this year, compared with 2.6 million laser printers, 1.8 million ink jet printers, and 100,000 thermal printers. The market has two broad segments: the market for expensive, powerful data printers ($1,000 and up), which will never be obsolete as long as multipart forms exist, and the vastly larger personal printer market, focused on narrow-carriage, 24-pin devices that cost only fractionally more than 9-pin printers.

Market leaders Epson, Panasonic, Okidata, Star Micronics, and Citizen continue to find technologies that keep their products from being dragged down to commodity status. Citizen, Epson, Panasonic, and Star Micronics offer scalable fonts (either resident or via software), for instance, and Panasonic has a low-noise line. Virtually all vendors have full-color lines. By the end of 1993, you should be able to find the cheapest 24-pin printers selling for less than $150, and the cheapest 9-pin printers for less than $100.

Multifunction printers (hydra printers) are beginning to combine laser printing with scanning, faxing, and convenience copying.

THE FUTURE: HYDRA PRINTERS

Looking into the near future, expect to see the emergence of two new classes of printers (these were not reviewed in this issue). One is the multifunction (or hydra) printer, which combines laser printing with scanning, faxing, and convenience copying. Okidata was one of the first vendors to deliver this type, with the DOCIT 3000, a $3,999 system based around an 8-ppm, 300-dpi LED array print engine and an in-PC controller with an Intel i960 KB processor. The Canon Bubble Jet Desktop Digital Color Copier CJ10, priced under $10,000, is a copier/scanner/printer that provides 400-dpi resolution and can connect to a computer via an optional Intelligent Processing Unit (IPU).

The other technology you're likely to see is the 35- to 50-ppm departmental photocopier given a network printer interface. Vendors might include Canon, Konica, and Minolta. In performance and price, these products would fall between today's 12- to 30-ppm laser printers and the $100,000-plus Kodak Lionheart and Xerox Docutech printers, which require a full-time attendant.

REVIEW CRITERIA

This issue marks our ninth annual review of new printers. The review criteria are simple: We sought out for testing any new printers that can be connected to a PC, and any printers that were previously reviewed but have been substantially enhanced. For this issue, we included new printers that secondary vendors had licensed from the OEM (in most cases, we did not review repackaged versions of products we've reviewed in the past, except when the licensee had significantly enhanced the original unit).

We also required that the printer support a standard PC printer language. This year, we extended that definition to include laser printers that provide their PCL or PostScript emulations via software loaded onto hard or floppy disks built into the printers.

The exceptions to our all-inclusive coverage are portable printers, which were reviewed recently in our single-topic issue on portable computing (August 1992), and plotters, which represent a speciality technology that has not been part of our annual printer issues.

This year, printers are divided into five major sections, reviewed in the following order:

- **Mainstream lasers** (4 to 10 ppm). This section includes printers based on LED and LCD technologies, as well as true laser models. About half of these printers are likely to be connected to networks, and while we don't formally test their network abilities, we do indicate those that are well suited to the task, particularly those running at 8 ppm and above. In this issue, we review 34 page printers.
- **Shared lasers** (12 ppm and above). Any printer running at 12 ppm or higher is almost certainly going to be shared among several users, and it may well be directly attached to a network. In this section, we look at both cut-sheet and continuous-

SMART. AFFORDABLE LASER PRINTING FROM PANASONIC.

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So although you'd like a personal laser to adapt to your way of working, it's mostly the other way around

So, besides lots of fonts, speed, and paper capacity, we gave our KX-P4410 personal laser printer two features you'll find intelligent indeed. One lets you proof the first copy of a multiple printout, before outputting the remainder. The other is automatic shutdown, for those of you who use delayed printing. Together, they help you print intelligently. And complement the PCL 4-compatible 4410's full range of features that give you the look you want.

Like 28 internal fonts, side-loading font card. 512K standard memory, expandable to 4.5 megabytes. And flexible paper handling, with a 200-sheet multi-purpose cassette, accommodating letter and legal sized sheets plus envelopes—without changing cassettes All this and a true 5 pages-per-minute print speed!

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Choosing a Printer: A Look at the Options

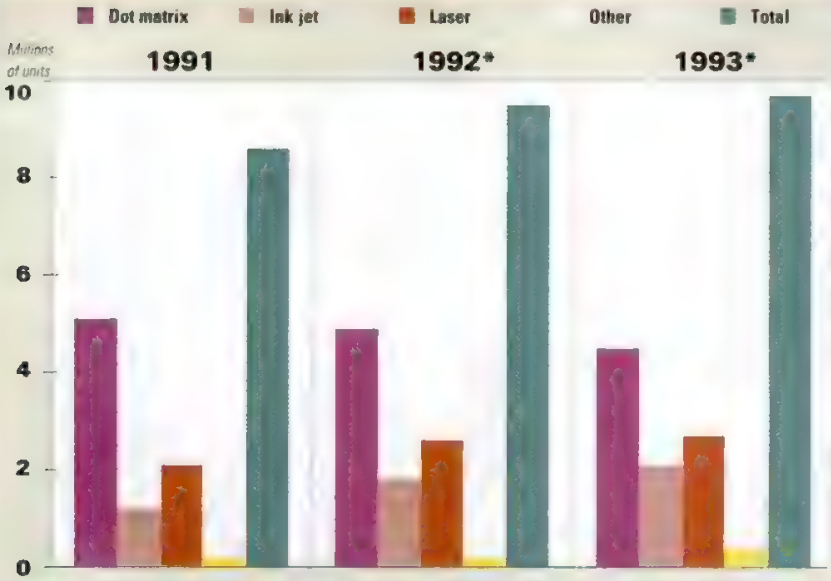
This decision tree summarizes the pros and cons of the major printer categories: dot matrix, ink jet, mainstream laser, shared laser, and color PostScript. It takes into account not only the new printers reviewed in this issue, but also older printers that are still available.

Use this as a guide to help you assess your needs and determine which type of printer is likely to be best suited to meet them. Remember that these categories define the capabilities of most printers; some units may fall outside the descriptions given here.

The Printer Market: Lasers and Ink Jets on the Move

The U.S. market for PC-compatible printers is expected to total 9.5 million units this year, up substantially from the 8.6 million sold last year. Ink jet and laser printers showed the most growth. Dot matrix sales continued to decline slowly (though still making up over half of the market). "Other" printers include such categories as color PostScript printers.

U.S. PRINTER SALES, 1991 TO 1993



Source: BIS Strategic Decisions * Projections

LEADING MANUFACTURERS

	9-pin dot matrix	24-pin dot matrix	Ink jet	Laser
1	Epson	Panasonic	Hewlett Packard	Hewlett-Packard
2	Okidata	Epson	Canon	IBM
3	Panasonic	Citizen	Eastman Kodak	Okidata
4	Star	Star	DEC	Panasonic
5	Citizen	Okdiata	Star	Epson
6	IBM/Lexmark	IBM	Brother	Texas Instruments
7	Brother	NEC	*	NEC
8	Alps	Fujitsu	*	QMS
9	Seikosha	Alps	*	Brother
10	Fujitsu	Brother	*	Eastman Kodak

* Only six manufacturers of ink jet printers have a significant presence in the PC-compatible marketplace

Source: BIS Strategic Decisions (based on 1991 unit sales)

form page printers (the latter is a new category for *PC Magazine*). Of these 16 printers running at 12 to 30 ppm, 4 arrived with network interfaces. For those 4 systems, PC Magazine Labs ran its Text Speed and Graphics Speed tests both via the parallel port and using the network interface.

• **Color PostScript printers.** Solid ink, thermal wax transfer, or dye sublimation technologies, along with Adobe PostScript or a compatible interpreter, put these eight color PostScript printers a clear level above most available color ink jet printers in terms of quality.

• **Ink jet printers,** color and monochrome. While the number of new products we review here is relatively small (seven), this is a rapidly expanding market. Look at our August 1992 issue on portable printers for information on five more ink jet printers.

• **Dot matrix printers** (9-, 18-, and 24-pin), as well as line printer emulators. We examine 35 dot matrix printers in the current issue.

NEW TESTS FOR NEW TECHNOLOGIES

As printers and printed material become more sophisticated, so too do our tests. This year, PC Labs has considerably revamped its standard Graphics Speed test, though the Text Speed test remains nearly identical to the old version. For all the printers, we ran these tests using parallel or serial connections. For those shared laser printers that were sent to us with Ethernet network interfaces, we also ran the Text Speed and Graphics Speed tests using an Ethernet connection across a NetWare network, and we are reporting the test results for both configurations.

Among the other tests new this year are Windows applications tests using Word for Windows and CorelDRAW. And this year, our evaluations of high-end color PostScript printers include tests to assess the purity of color output. (See the sidebar "How We Tested the Printers" for more information on our procedures.)

ABOUT THIS ISSUE

Each section of the present printer story contains an introduction, product reviews, a highlights box, the Editors' Choice, and our Printer Guides, which show output samples from each unit. As usual, the reviews are in alphabetical order by company name. Where a company has multiple products in a category, they are grouped in a single review; where two companies market essentially the same printer, the unit is reviewed once, under the name of the company that comes first alphabetically.

In this issue, you'll also find an index to earlier *PC Magazine* reviews of printers that are still available, as well as two special pullout sections: One is a handy selection of tips for laser printer users, and the second encompasses color printing tips and a sampling of the color output you can expect from various printer technologies.

This year's printer blockbuster also includes a service and reliability report, in which 15,000 readers report their satisfaction with leading printer brands. Perhaps not surprisingly, the names that come to mind most when you think of printers—Hewlett-Packard, Epson, and Panasonic—show the highest levels of user satisfaction. □

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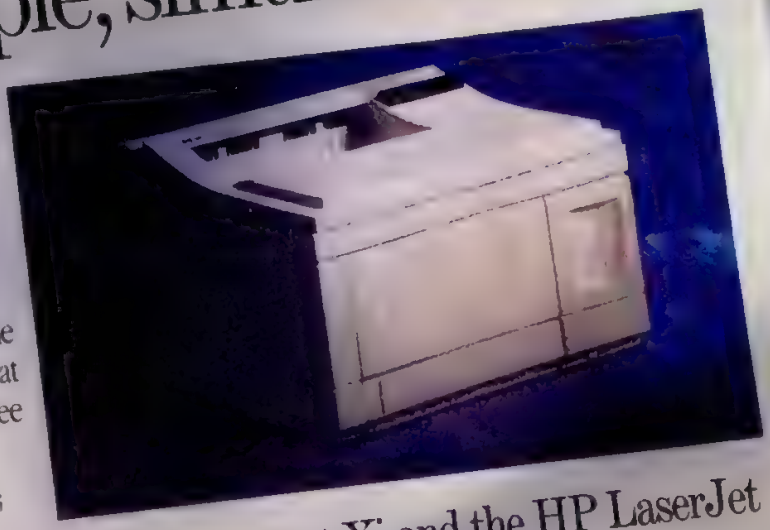

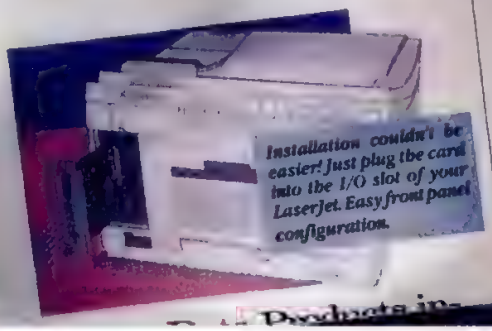

Pacific Connect Xi and the HP LaserJet

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5 port (4 serial, 1 parallel)	$399	7 port (6 serial, 1 parallel)	$599
10 port (10 serial)	$599	10 port (10 serial)	$699

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SAN DIEGO—Pacific ... on the LaserJet II, IID, ... This includes the price

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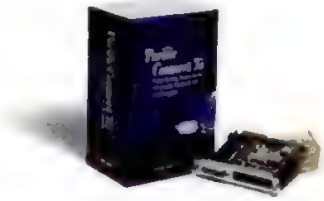

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Getting Better All The Time

Higher resolutions, improved halftones, greater support for HP PCL 5 and Adobe PostScript Level 2, more RISC processors . . . If you buy a laser this year, you'll get more for your money than ever before.

by Mary Kathleen Flynn

You're probably not too surprised to hear that desktop lasers got cheaper over the past year. What PC hardware didn't? The big news is that personal lasers got better.

In lots of ways. Higher resolutions, enhanced halftones, and wider support for HP PCL 5 and Adobe PostScript Level 2 make the output quality of today's lasers superior. RISC processors, improved parallel ports, and built-in Windows functions add speed. And SCSI ports, automatic port and emulation switching, and network options make many of these 34 mainstream lasers—those with engines rated at 10 pages per minute or less—easier to use in workgroups.

RESOLUTION BOOSTERS

When it comes to print quality, the sexiest—and most touted—improvements have come from increased resolutions. For true resolutions higher than 300 dots per inch, you have more choices today than ever before. Of the 34 products represented in this roundup, the following provide resolutions that go beyond the standard 300 dpi: Hewlett-Packard's brand-new HP LaserJet 4 ($2,199) and HP LaserJet 4M ($2,999); LaserMaster's Unity 1000 ($6,995), Unity 1200xl ($9,995), and WinPrinter 800 ($1,595); Lexmark International's IBM LaserPrinter 6P ($2,295) and LaserPrinter 10P ($3,795); most of NewGen Systems' TurboPS series printers; and Xante's Accel-a-Writer 8000 ($3,295). And the HP printers' enhanced PCL 5 language breaks new ground by providing 600-dpi text *and* graphics in that mode, not just in PostScript.

As you can tell from this list, however, 600-dpi printers still are not commonplace. But more high-resolution choices are on the way. Two that missed our

Photograph by Scott Wippermann

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deadline but should be available by now are the DataProducts LZR 965 ($2,995), a 9-ppm, 600-dpi PostScript printer, and the 8-ppm QMS 860 Print System ($4,595), a B-size (11 by 17 inches), 600-dpi PostScript Level 2 printer.

Soon, 600-dpi printing should be as inexpensive as 300-dpi printing. Intel's new 82961KD printer coprocessor, which works with its i960 RISC processor, uses hardware banding and compression to reduce memory requirements significantly. And memory, according to Intel, is the most expensive component of high-resolution printing. The first printer to use the new chip, capable of resolutions up to 1,200 dpi, is Calcomp's CCL 600, which should be available this quarter. Based on Canon's new 600-dpi, B-size BX engine, the CCL 600 is an 8-ppm, 600-dpi PostScript printer.

At $3,995, the CCL 600, like the $4,595 QMS 860, will be competitive with the lower prices we're starting to see for B-size lasers. Prices for some of these printers fell to as low as $6,000 earlier in the year, and most recently, to about $4,000 or less. Of the printers reviewed here, only the LaserMaster Unity 1200xl ($9,995) provides ledger-size printing. (See the Shared Lasers section for reviews of network B-size printers.)

ENHANCED IMAGES

But increasing the resolution is only one way printer vendors have improved output this year. Several companies have developed technologies that enhance halftones (or shades of gray, also known as *gray scales*), which has led those vendors to boast of increased *perceived* resolutions—beyond even the true 600-dpi (or higher) output that some of them offer. These include Acer (in its Acer Laser IIIG, not reviewed here because it was being upgraded at test time), Apple Computer, Destiny Technology (the controller maker), LaserMaster, NewGen, Okidata, Samsung Electronics America (in its forthcoming ImageResolution Kit, $995), and Xante. (See the sidebar "Hi-Res? No, Better Halftones.")

And crisper text and line art is practically a given today. Since HP introduced its Resolution Enhancement Technology (RET) in the HP LaserJet III two years ago, many printer vendors have delivered similar technologies to improve the quality of text and line art. In this roundup, all but the Apple Personal LaserWriter NTR ($2,199), Epson ActionLaser II ($999), HP LaserJet IIP Plus ($1,249), Panasonic KXP-4410 ($1,095), Samsung Finalé 8000 ($1,995), and Texas Instruments' TI microLaser Turbo ($1,749), as well as the NewGen TurboPS/300p ($1,995) and Turbo PS/630En ($3,995), used RET-like approaches. The NewGens can be equipped with the capability via their IET Level 1 options, and the Finalé can gain it (and true 600-dpi resolution) with its ImageResolution Kit that should be available this quarter.

Other output-quality improvements include wider support for PCL 5 and

HIGHLIGHTS

Mainstream Lasers

MORE VALUE for the dollar is the promise of today's personal laser printers. Prices have come down by as much as 9 percent, while features have multiplied. Resolutions of 600 dpi or better, crisper text and line art, and improved halftones are only some of the enhancements today's laser printers now incorporate.

GREATER SUPPORT for HP PCL 5 and Adobe PostScript—not to mention Adobe PostScript Level 2—is characteristic of many of today's lasers. That, together with the improvements in actual or perceived resolution, translates into higher-quality output.

SPEED IMPROVEMENTS come by way of faster parallel ports, built-in Windows functions, dual-page processing, and more RISC processors.

THIS YEAR bidirectional communications came to the parallel port. Hewlett-Packard includes the feature in its LaserJet 4 and 4M, while other companies have proposed an alternative specification.

THE 10-PPM Fujitsu Print Partner 10 wins hands-down in the PCL-mode Text Speed race, while the 10-ppm IBM LaserPrinter 10P takes top honors in the PostScript-mode Text Speed category. The Samsung Finalé 8000, with a score of 3.6 gppm, was the fastest performer on our PCL-mode Graphics Speed test.

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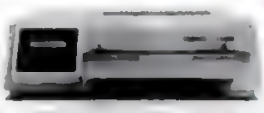

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CIRCLE 056 ON READER SERVICE CARD

EDITORS' CHOICE

- **Fujitsu Print Partner 10**
- **HP LaserJet 4**
- **HP LaserJet 4M**
- **Kyocera Ecosys a-Si FS-1500A**
- **IBM LaserPrinter 10P**
- **NEC Silentwriter Model 95**

Cheaper. Faster. Better. That's the verdict on this year's crop of 34 mainstream laser printers (those with engines rated at 10 pages per minute or less). In this group you'll find printers that are best suited for personal use, as well as systems that can perform comfortably in a small- to medium-size workgroup environment. You'll find some features that enhance speed and others that boost output quality. And you'll see some innovative designs in the form of PostScript fax options, PCMCIA slots, and photoconductors that last the life of the printer. This year, six mainstream lasers earn our Editors' Choice award: the Fujitsu Print Partner 10, the HP LaserJet 4 and HP LaserJet 4M, the Kyocera Ecosys a-Si FS-1500A, the IBM LaserPrinter 10P, and the NEC Silentwriter Model 95.

HP 4 SERIES

HP takes a few evolutionary steps forward with its two 8-ppm printers, the $2,199 LaserJet 4 and $2,999 LaserJet 4M. New in this year's LaserJets are an enhanced version of PCL 5 that allows 600-dot-per-inch graphics and text printing, the first implementation of the Canon P-270 engine, a 20-MHz Intel 80960 RISC processor, a fast parallel port (156 kilobytes per second continuous transfer rate) that can also handle bidirectional communications, a second paper tray as standard, and 35 built-in Intellifonts plus 10 built-in TrueType fonts. With both printers, you get output with higher apparent resolution than all other 600-dpi models we've seen.

The LaserJet 4M adds true Adobe PostScript Level 2 and an AppleTalk interface as standard equipment. You can upgrade the LaserJet 4 to PostScript Level 2 with a $499 SIMM.

Of course, you still get RET, HP's Resolution Enhancement Technology that has been standard on its laser printers since the LaserJet III. And in at least one way, HP's new models play catch-up to some competitors: They now feature the ability to switch automatically between emulations.

The LaserJet 4 packs in all these features for about $200 less than the now-discontinued 300-dpi HP LaserJet III. And the 4M costs less than the combined price of the LaserJet III and HP's PostScript upgrade cartridge. The single disappointment on these models is the lack of a provision to add an internal hard disk for font storage.

The latest LaserJets run faster than ever. On our PCL-mode Text Speed test, both units managed 7.9 ppm—faster than all but one of the 8-ppm printers reviewed here. The LaserJet 4M kept up the pace on our PostScript-mode Text Speed test, besting its 8-ppm competition. Whether you plan to use these as personal printers or on a small- to medium-size network (HP offers its JetDirect network interface cards in Ethernet and Token-Ring versions), their performance shouldn't disappoint you.

10-PPM WINNERS

Last year, features such as excellent 300- and 600-dpi output, good speed, and a plethora of paper-handling options won the IBM LaserPrinter 10 an Editors' Choice. This year, Lexmark's IBM LaserPrinter 10P boasts the same wide range of features, adds a faster parallel port, and incorporates Adobe PostScript in its standard configuration. And it's quite a successful implementation: In PostScript mode, the LaserPrinter 10P boasted the fastest Text Speed output of all the printers, pushing through 8.8 ppm on our tests. Its PostScript-mode Graphics Speed scores were a bit less fantastic, though still well within the expected range. And while it wasn't the fastest performer on our PCL-mode tests, it was no slouch, either.

With its true 600-dpi resolution and PQET resolution enhancement technology, the LaserPrinter 10P provides top-quality output, second only to the HP LaserJet 4's and the LaserMaster high-res offerings. If you're interested in this model for workgroup jobs, you'll appreciate options like the IBM 4033 LAN Connection interfaces that take advantage of the printer's fast parallel port, and features such as automatic shutdown when the output bin is full. The unit also offers automatic emulation switching via a TSR—a less elegant solution than some, but equally effective.

If it's a fast PCL text printer you're after, put the $1,995 Fujitsu Print Partner 10 on your list. With a score of 10.1 ppm on our Text Speed test, the Fujitsu printer (which includes an AMD 29000 RISC processor) ran circles around its competition. Its Graphics Speed score, at 3.1 graphics pages per minute, was extremely close to that of the 3.6-gppm leading-edge performance of the Samsung Finalé 8000. Fujitsu doesn't offer the same level of networking options that Lexmark and HP do, but it does provide automatic emulation switching (albeit through software) that will enhance its usefulness for networks. Fujitsu's resolution enhancement technology provides for good 300-dpi output, and its easy-to-use control panel ensures you'll be up and running quickly.

If low per-page costs, an extensive range of fonts and font options, duplex printing (via an option not available at press time), a complete selection of network interfaces, good PCL performance, and environmental awareness

appeal to you, check out the 10-ppm Kyocera Ecosys a-Si FS-1500A ($2,395). Its list price is a little higher than most of its competitors, but the unit boasts a drum that should last the life of the printer: You replace toner powder rather than toner cartridges. This ensures low operating costs of about 8 cents per page, compared with about 3 cents for most competitors.

A PERSONAL CHOICE

If you're looking for a low-cost, high-quality personal printer, look no further than the NEC Silentwriter Model 95. A 6-ppm unit, the NEC costs $1,749, includes both PCL 5 and Adobe PostScript Level 2, and produces good-quality, 300-dpi output with the help of its edge enhancement technology. It also stands out for having been the first printer to market with a PostScript fax option ($599).

Its PCL-mode Text Speed score matched its 6-ppm engine speed; in PostScript mode, its 5.8-ppm Text Speed score outranked its 6-ppm competitors. If your workgroup needs are light enough for a 6-ppm system to handle, you'll also appreciate the NEC's standard AppleTalk and optional Ethernet interfaces.

HONORABLE MENTION

One printer that deserves special mention here is the 8-ppm LaserMaster Unity 1000 ($6,995). While the price is prohibitive for many users, those who need typeset-quality, camera-ready output will be intrigued. With a top resolution of 1,000 by 1,000 dpi, achieved in part through LaserMaster's TurboRes enhancement technology, this system's output is superior. Even scrutinized under a magnifying glass, jagged edges and other distractions are invisible. Its output quality is matched only by the company's B-size Unity 1200xl ($9,995), but better all-around speed, operation, and performance (although it was unable to pass our PCL Torture Test) earn the Unity 1000 honorable mention over its more expensive sibling.

PostScript Level 2. Last year, only two desktop lasers had PCL 5 support; this year, 18 support PCL 5 either in their standard configurations or as an option. For information on software that will let you add PCL 5 capabilities to older printers, see the sidebar "Moving On Up to PCL 5."

PostScript continues to gain acceptance. InfoCorp, the market research house based in Santa Clara, California, expects 17 percent of all 7- to 14-ppm lasers sold this year to include PostScript (up from 15 percent last year). In this review, 19 of the 34 printers provide PostScript as a standard feature; another 13 offer it as an option. While only one printer in last year's annual printer issue supported PostScript Level 2, six support it now.

SPEED-UPS

This year's lasers are more efficient at processing information, which is why you'll see speed improvements over past years, even within the same pages-per-minute category. Of course, since our tests have changed this year, you should be careful about making across-the-board comparisons between these printers and past reviews, especially when it comes to the Graphics Speed test. The new Text Speed test, however, is almost identical to the old version.

Almost half the systems we saw this year use a RISC processor. Because RISC processors use fewer instructions to accomplish tasks, jobs are completed more quickly. This is especially helpful in calculation-intensive applications, like printing a complicated graphics page. Although other factors come into play, the effectiveness of a controller's RISC processor is reflected in part by our new Graphics Speed and Windows applications tests.

Some vendors, most notably Xante, have implemented dual-page processing to help speed performance. In Xante's Accel-a-Writer 8000, this allows a second page to be created in memory while the first is printing. (For information on add-in boards that accelerate printing, see the sidebar "Faster Windows Printing with WinJet and PrintSprint.")

Perhaps the most exciting news on speed is that the new HP LaserJet 4 and LaserJet 4M are faster than their predecessors. Where the older LaserJets produced roughly 7.5 ppm on our Text Speed test in PCL mode, the new pair scored very close to their 8-ppm rated speed, and the 4M managed the same on our PostScript-mode Text Speed test. HP attributes the improved performance to several features: the Intel RISC processor, a graphics-optimized version of PCL 5, integrated PostScript Level 2, and faster printer drivers.

Also new in HP's printers is a speedier parallel port. According to HP, the new port transfers data continuously at up to 156 kilobytes per second (KBps)—about ten times as fast as standard printer parallel port. Other printers in this review that sport faster parallel ports are the Lexmark units (with a continuous transfer rate of 70 KBps) and the Brother models, which move data at continuous transfer rates up to 38 KBps for the Brother HL-10V and 55 KBps for the HL-4Ve. (Our Text Speed and Graphics Speed tests won't show the effect of a faster parallel port because these tests do not use the printers' drivers. Nor will you see it on our Windows applications tests; these tests do not isolate data transfer times, where a faster parallel port will have its greatest impact.)

HP's new parallel port also provides bidirectional communications. The printer can send status messages to users' screens when it needs servicing, more paper, or more toner. While no software applications take advantage of this yet, HP's bundled Explorer utility is a start: It allows users' PCs to act as remote printer control panels. The Network Printer Alliance—which includes Adaptec, Destiny, Intel, Lexmark, and others—has proposed an alternative spec for bidirectional communications (Trends, *PC Magazine*, June 16, 1992).

PERFORMANCE TEST RESULTS

Among the attempts to improve Microsoft Windows 3.1 printing speed are HP's decision to include 10 TrueType fonts on the LaserJet 4 and 4M, and the Samsung and Apple designs that build TrueType font rasterizers into ROM on their models. LaserMaster's WinPrinter 800 is essentially a dumb printer with some smart software: a driver that makes direct calls to Windows' Graphics Device Interface (GDI), and the WinPrint Manager, which

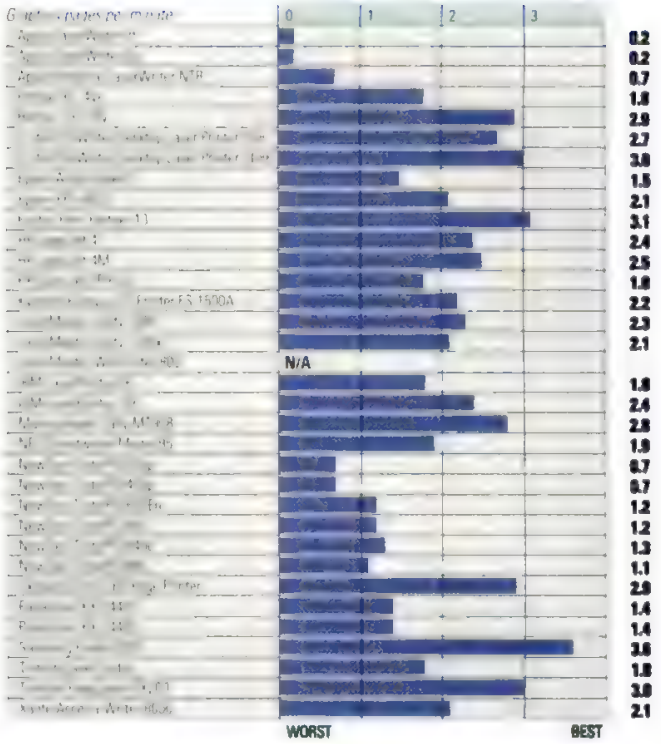
Performance Tests: Mainstream Lasers

The 10-ppm Fujitsu Print Partner 10 won the Text Speed race in PCL mode, even exceeding its rated engine speed. The 10-ppm Epson EPL-8000 stood out as the second-fastest PCL Text Speed performer. The Okidata OL810 LED Page Printer surpasses this year's 8-ppm-rated competition on the PCL-mode Text Speed test, followed closely by the HP LaserJet 4 and 4M. No other printer could exceed the PostScript Text Speed performance of the IBM Laser-Printer 10P.

On the Graphics Speed test, the Samsung Finalé 8000 took top honors in PCL mode, while the LaserMaster Unity 1000 and NewGen TurboPS/880 outdid the competition in PostScript mode.

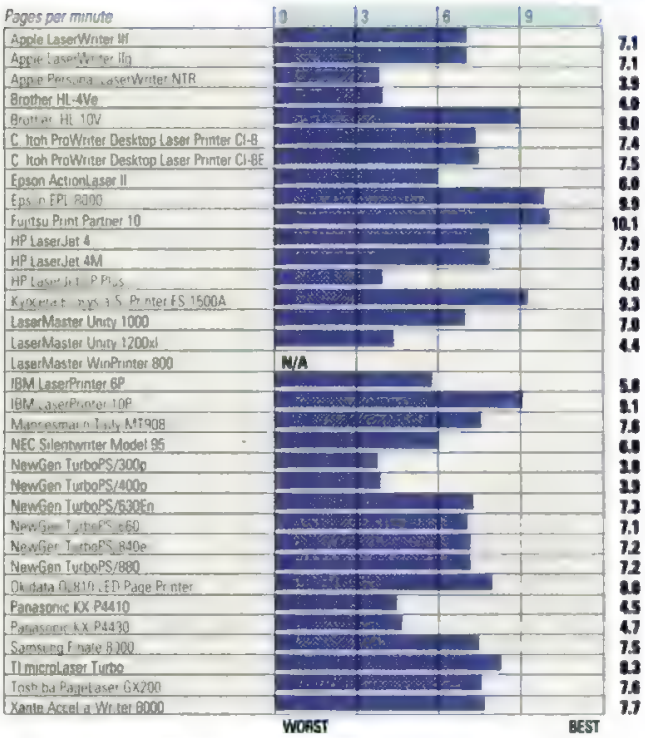
CONTINUES

GRAPHICS SPEED (PCL)



N/A—Not applicable. The printer could not perform this test

TEXT SPEED (PCL)



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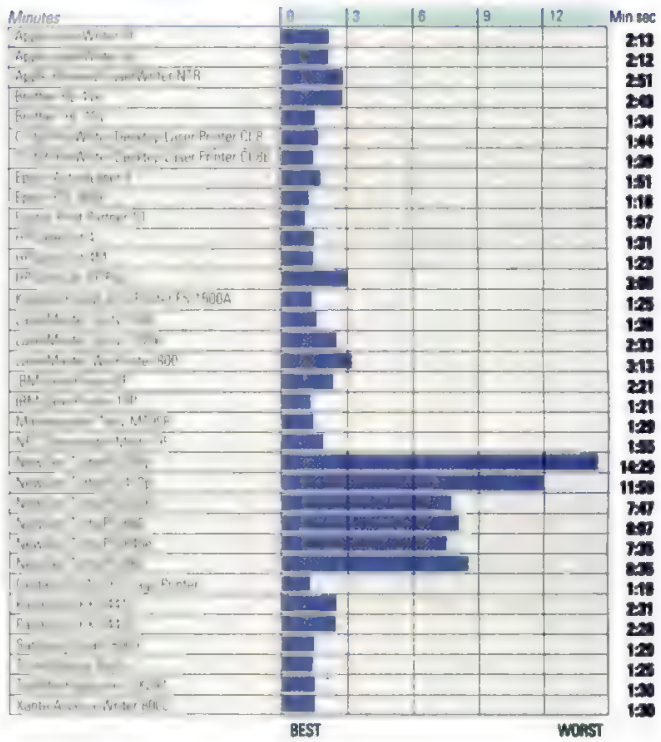
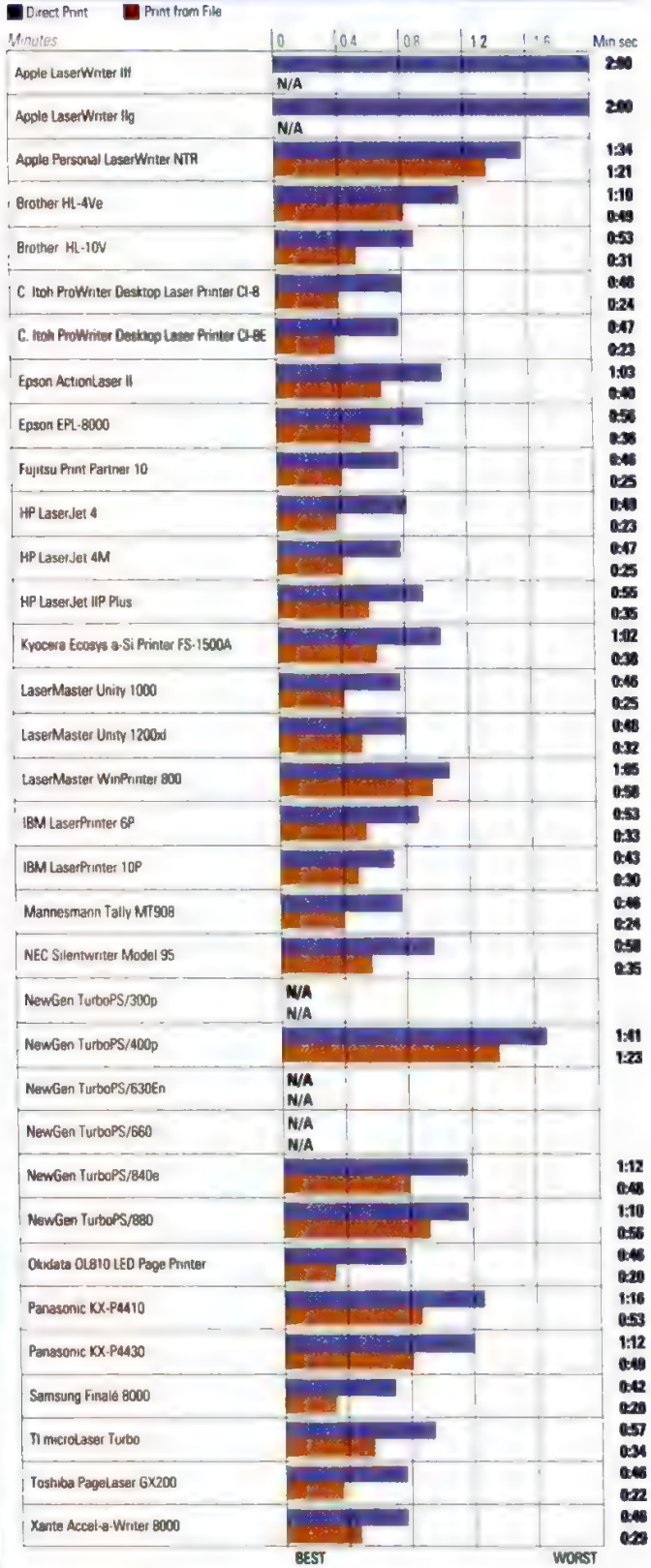
WORD FOR WINDOWS (PCL)



Performance Tests: Mainstream Lasers

CONTINUES

CORELDRAW (PCL)



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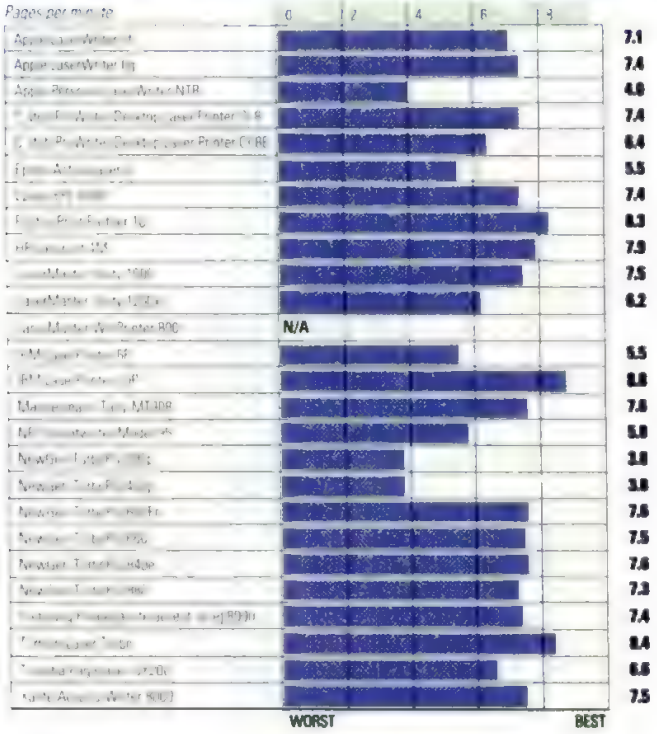
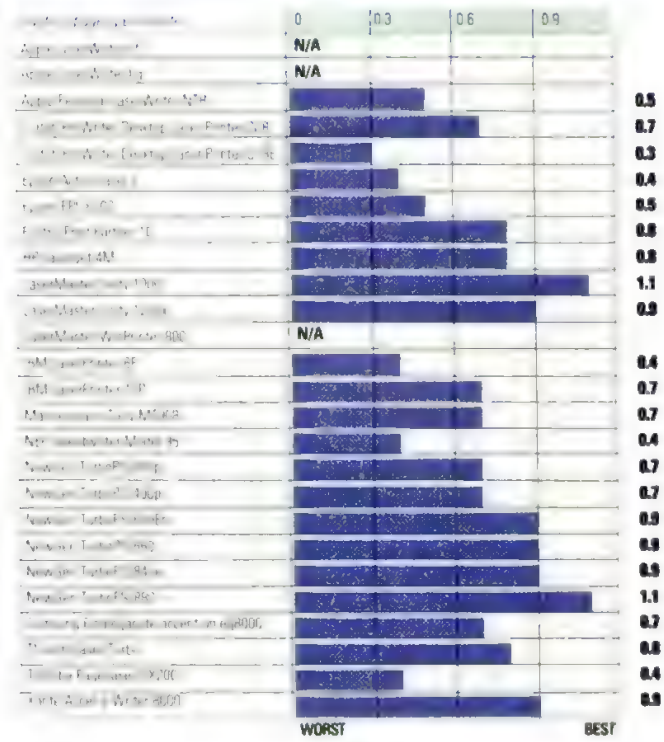
TEXT SPEED (PostScript)



N/A—Not applicable. The printer could not complete this test

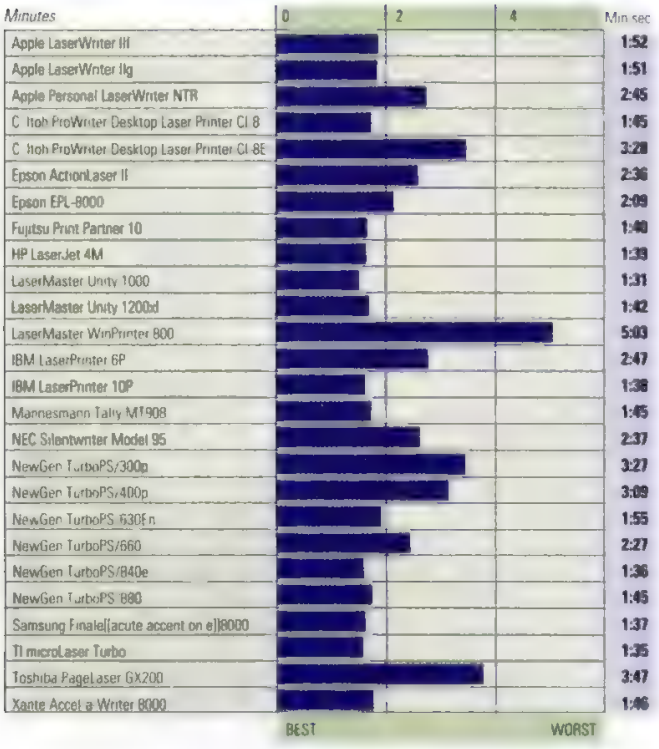
GRAPHICS SPEED (PostScript)



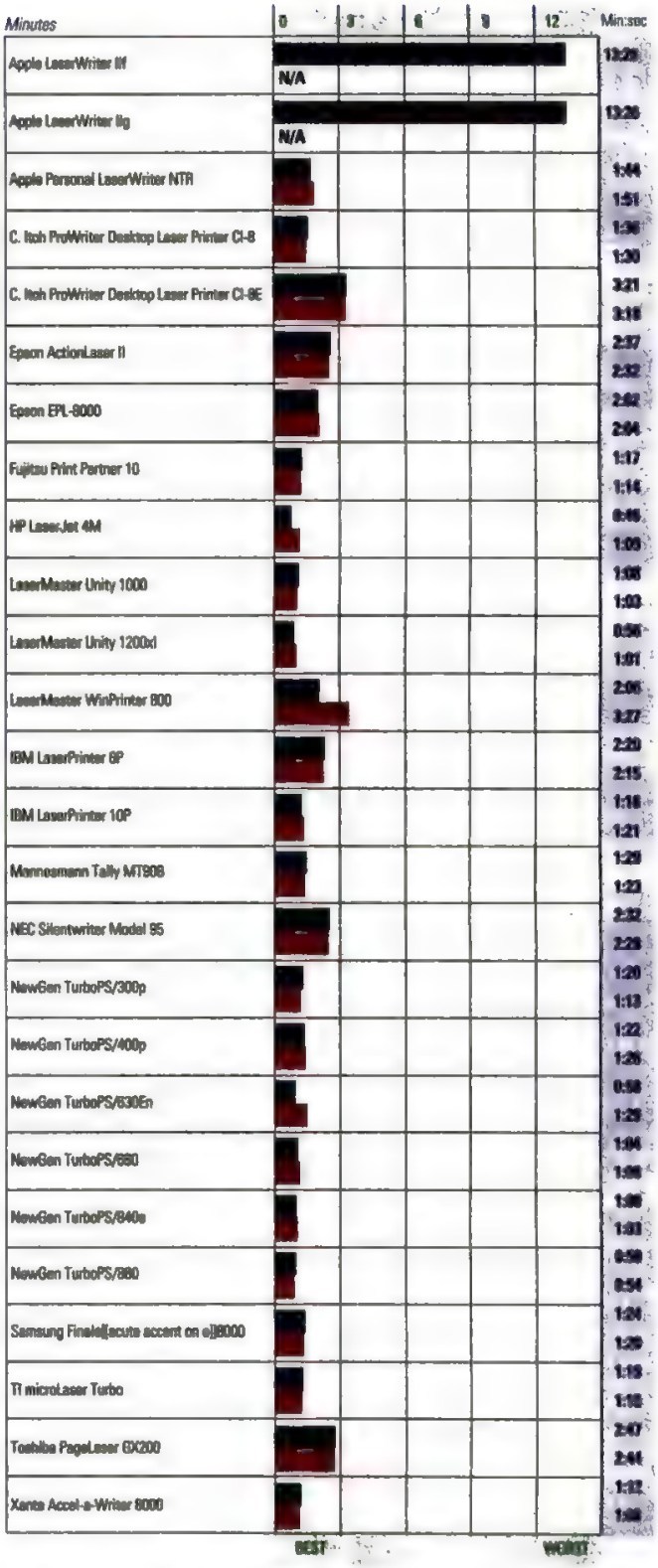
N/A—Not applicable. The printer could not complete this test

ENDS

WORD FOR WINDOWS (PostScript)



CORELDRAW WINDOWS (PostScript)



N/A—Not applicable. The printer could not complete this test.

We tested all the printers but the Apple LaserWriter IIf and IIg using the parallel port. These printers have only a serial port, and we tested their performance over that port at 9,600 bps.

The LaserMaster WinPrinter 800 was unable to complete our Text and Graphics Speed tests, which are DOS-based, because it is specifically designed for Windows operation.

We performed each test in PCL mode and again in PostScript mode, for those printers that support it.

The **Text Speed** test measures the printer's speed in sending and printing ten copies of a two-page business letter with 1-inch margins in 10-cpi type.

The **Graphics Speed** test measures the printer's speed in sending and printing two copies of a graphics image created using CorelDRAW and Microsoft Windows 3.1.

The **Word for Windows** test records the time required to print a ten-page business report that uses multiple fonts and type styles. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

The **CorelDRAW** test measures the time required to print a CorelDRAW graphics file. We run the test in two different ways: first as a direct print from within the application (Direct Print) and then as a print of a pregenerated file external to the application (Print from File). It uses the same graphics file as the Graphics Speed test does. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

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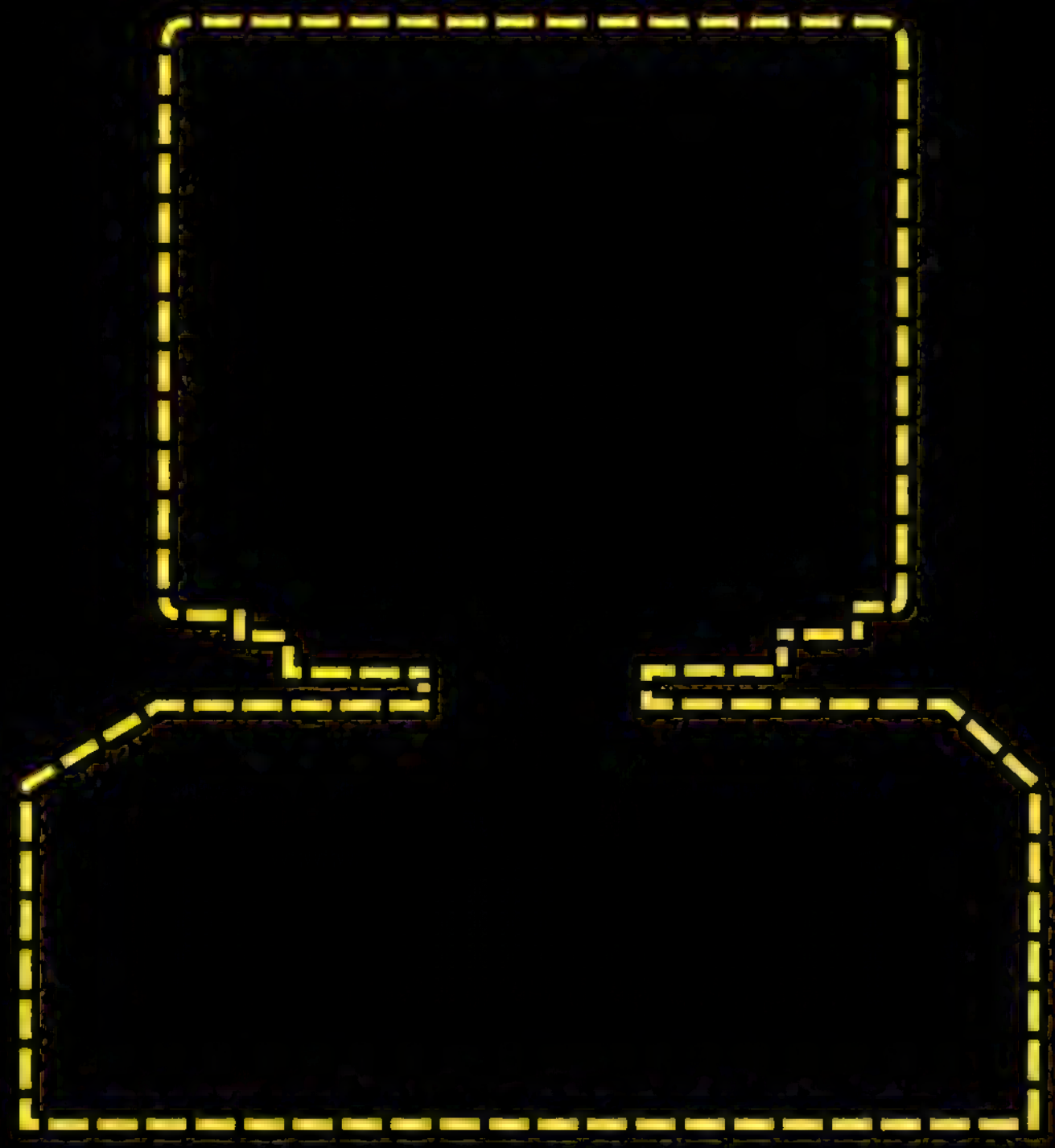

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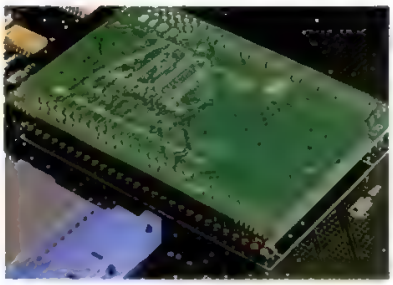

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Of course power and expandability are ZEOS hallmarks. In their haste to cut features and to cut prices it would seem the others have forgotten about your future. That's why ZEOS has things like *eight* expansion slots, *high-capacity* power supplies and *seven* drive bays all in our standard SpaceSaver desktop cases. We care about you and the long-term ownership of your new computer. We invite comparison. The more you look, the more obvious your ZEOS advantages become.

Like the two cooling fans you'll find in every ZEOS system. While ZEOS systems run cooler than most with *one* fan we still give you *two whisper-quiet cooling fans.* The cooler your system runs the longer it will last. We also include a *built-in surge suppressor* in every system. It's all part of ZEOS' built-in Award Winning reliability. Of course every ZEOS system carries the Underwriters Laboratories listing as well. These are extra features the others *can't* or *won't* offer you. From ZEOS, they're yours. No additional charge.

FREE LOTUS SOFTWARE TOO!

And don't forget, when you purchase any new ZEOS Windows based system, you will also receive your choice of two: *Lotus 1-2-3 for Windows, Ami Pro,* and *Freelance Graphics.* You're going to love it. The software alone carries a suggested retail price of over $1,000 and we're giving it to you *absolutely free.* Now that's ZEOS Value.

24-HOUR-A-DAY SUPPORT. AND MORE!

Remember too, ZEOS provides you with our top-rated 24-Hour-a-Day Toll-Free Technical Support. *Plus* your new ZEOS system is covered by our 30-Day Money-Back Guarantee, One Full Year Limited Warranty, and our Express Parts Replacement Policy.

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There is no question. While everyone else is cutting prices by giving you less, ZEOS is cutting prices and giving you more. Whether you choose the 486SX-25, the amazing 486DX2-66 or anything in between—*ZEOS gives you the most for your money.* So go ahead and give us a call.

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Ordering your new ZEOS upgradable system is easy. Simply pick up the phone and give us a call. A friendly and knowledgeable ZEOS Systems Consultant is ready to answer any questions you may have. You're going to love your new ZEOS system. *Why not give us a call right now!*

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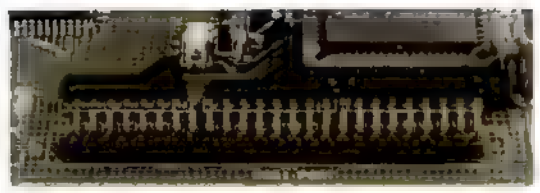
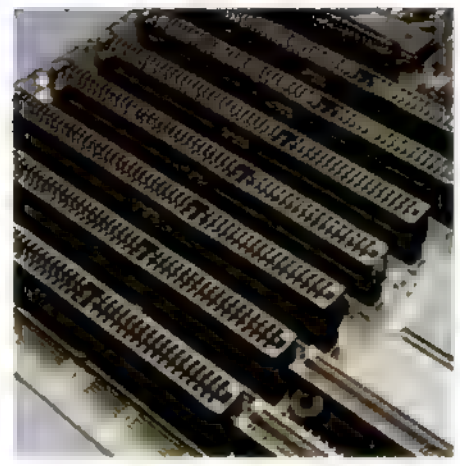
ZEOS systems feature award winning reliability and support. Nine times PC Magazine's *Editors' Choice.*



The on board SCSI option lets you add SCSI I or II devices anytime. SCSI hard drives, opticals and more are easy to add.



Eight expansion slots provide you with plenty of room to add to your system in the future.

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ZEOS Complete System Package #1

- Your choice of CPU with upgrade options. Our Zero Insertion Force (ZIF) upgrade socket makes it easy.
- 2MB of high-speed RAM expandable to 64MB on board.
- 85MB high-speed IDE hard drive with built-in cache.
- 1.2MB or 1.44MB Teac® FDD.
- ZEOS 14" Hi-Res mono VGA monitor with 1MB high-speed VESA Local Bus card.
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Incredible ZEOS Package #2

We take package #1 and add more memory, a bigger drive, both floppies plus Windows, a MS Mouse *and* your choice of two Lotus Windows software applications, free!

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- Our 130MB high-speed IDE hard drive with built-in cache.
- Both 1.2MB and 1.44MB Teac® floppy drives.
- ZEOS 14" Hi-Res 1024 x 768 non-interlaced VGA color monitor with 1MB high-speed VESA Local Bus card.
- Microsoft DOS, Windows and a genuine MS Mouse, your choice of two out of three Lotus applications for Windows: Lotus 1-2-3 for Windows, Ami Pro, and Freelance Graphics.

Incredible ZEOS Package #3

With Package #3 we add even more memory, a larger drive *and* even more savings.

- Pick the CPU power you want.
- 8MB of RAM expandable to 64.
- A full 245MB high-speed IDE hard drive with built-in cache.
- Both 1.2 and 1.44 Teacs.
- ZEOS 14" Hi-Res 1024 x 768 non-interlaced VGA color monitor with 1MB high-speed VESA Local Bus card.
- Microsoft DOS, Windows and a genuine MS Mouse, your choice of two out of three Lotus applications for Windows: Lotus 1-2-3 for Windows, Ami Pro, and Freelance Graphics.

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486SX-33	$1595	$2195	$2495	$3095
486DX-33	$1795	$2395	$2695	$3295
486DX2-50	$1995	$2595	$2895	$3495
486DX2-66	$2195	$2795	$3095	$3695

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- Our screaming 340MB IDE HDD.
- Both Teac® floppies.
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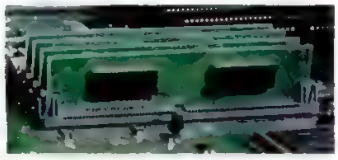

ZEOS gives you two local bus slots designed to the VESA standard, capable of local bus mastering.

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Because at no additional charge you're also getting extras like your choice of two of three great Windows applications: *Lotus 1-2-3 for Windows, Ami Pro* and *Freelance Graphics* with any ZEOS Windows system. And every system comes standard with built-in surge suppression, two cooling fans, our rugged seven-bay case, *and* the best 24-Hour Support package in the industry.

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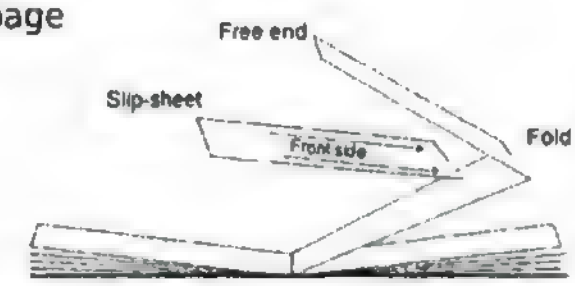
Folded edge of the page

GbsSlipSheet-001

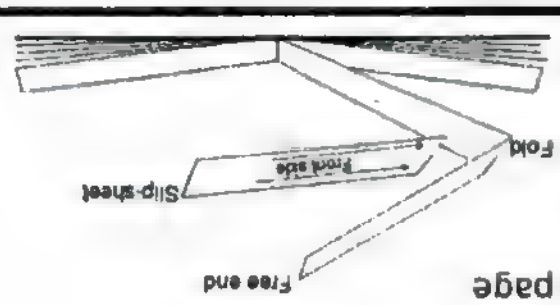
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



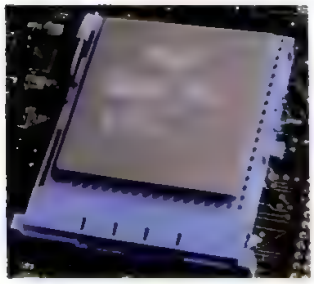
Back

1. Follow instructions on the other side

GbsSlipBack-001B

Inverted Back

1. Follow instructions on the other side



Pick your power! 486SX-25 thru the 486DX2-66. And upgrading is easy with our Zero Insertion Force (ZIF) socket. Note the extra row of pins for the future OverDrive™ CPU based on Intel's P5 technology.

When you buy any ZEOS Windows system you can choose 2 of 3 Windows applications: Lotus 1-2-3 for Windows, Ami Pro and Freelance Graphics for Windows!

New ZEOS® PCs!

You simply get more. For less. When everyone else started cutting prices by giving less, ZEOS had a better idea—Use the very latest technology to design an entirely new line of high performance upgradables that allow us to *charge less while giving more.* You're going to love it!

Because now these new ZEOS systems give you more of everything you're looking for. Speed, reliability, compatibility, 24-Hour Support and more. Plus, the ultimate in upgradability! No one else has anything like it, at any price. *You'll be amazed.*

Your new ZEOS upgradable system leaves everybody else in the dust. Just run the benchmarks and the others turn green with envy. But we don't just stop with PCs that are among the fastest in the world.

By using the very latest in 486 chip set technology we have been able to incorporate more new features than ever before.

TWO VESA STANDARD LOCAL BUS SLOTS.

While the others are talking about local bus, often creating their own non-standard solutions, ZEOS gives you a VESA future. As a working member of the VESA Standards Committee, ZEOS has incorporated *two* slots conforming to the recently established VESA standard.

More Features. Greater Pe

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How far beyond?

Try the future OverDrive™ processor based on Intel's P5 technology! Start today with the '486 CPU of your choice. Select between the 486SX-25 or 33, the 486DX-33, the 486DX2-50 or the 486-DX2-66. Then, in 1993, you'll be able to add the new super processor (you'll note the extra row of pins around each side of your CPU upgrade socket, that's what they're for). Maximum power today *and* tomorrow. When we talk power we're talking speed.

What does this mean to you?

Unparalleled VESA local bus performance! We've taken one of your two VESA local bus slots (which can also be used for standard 16-bit cards if you wish) and added a *screaming* local bus video card. Windows has never moved so fast! And with our bus mastering capability, a second local bus card can be added in the future as well. ZEOS gives you more performance options than anyone else. *Take a closer look!*

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With ZEOS, performance enhancements are standard. If you have a technical bent you'll love reading about them. If you're a typical user, just tell your friends your new ZEOS system has these things. They'll be impressed. Like what?

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Please complete all appropriate sections, *providing at least two years residence and employment history. THIS IS NOT A CREDIT AGREEMENT!* One will be sent to you upon authorization of an account. (This form must be signed to process your application.) All financed purchases are subject to credit approval. *If you have any credit questions, please call 800-421-8942 for assistance.* Thank you!

Name _____ Previous Address _____

Home Phone (____) _____ City _____ State _____ Zip _____

Soc. Sec. No. _____ Date of Birth ___ / ___ / ___ Employer _____ Since? (Mo./Yr.) _____

Address _____ Apt. _____ Monthly Gross Salary $ _____ Daytime Bus. Phone (____) _____

City _____ State _____ Zip _____ Previous Employer _____ From _____ To _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____ Occupation _____

A married person may apply for individual credit. I am applying for (please check appropriate box):

☐ **JOINT CREDIT** with another person. Complete entire application.

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.

☐ **INDIVIDUAL CREDIT.** Do not complete section C.**

** If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS:
YOU MUST DISCLOSE YOUR MARITAL STATUS:
☐ married ☐ unmarried ☐ legally separated

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income $ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

_____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE A:

Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	___	_____	Dept Store Charge Card	___	_____
VISA	___	_____	Credit Union Account	___	_____
MasterCard	___	_____	Other Major Charge Cards	___	_____
Finance Company Loan	___	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ___ / ___ / ___

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (____) _____ Monthly Gross Salary $ _____

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Applicant's Signature _____ Date _____

Joint Applicant's Signature _____ Date _____

FOR MARRIED WISCONSIN APPLICANTS: I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family.

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NY–A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report.

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ZCDJT-PCM-9211B

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CIRCLE 115 ON READER SERVICE CARD

runs as a Windows application on the host PC. The Lexmark printers also come with a Windows GDI Print Accelerator driver that was developed in conjunction with LaserMaster.

On our Windows tests, however, none of these printers exhibited the speed boost you might expect. The 4-ppm LaserMaster WinPrinter 800, for example, fell behind both the 4-ppm HP LaserJet IIP Plus and Brother HL-4Ve. And while the HP LaserJet 4 and LaserJet 4M were good performers on our Word for Windows test (where their internal TrueType fonts could come into play), they were not significantly faster than their peers. In fact, in informal testing, the LaserJet 4 actually performed better using downloaded TrueType fonts on our Word for Windows test document. Part of the reason for the slower performance using the internal fonts may lie with the font-substitution process, which occurs between the default fonts used to create the test file and the internal TrueType fonts used to output it.

In PCL mode, the $1,995 Fujitsu Print Partner 10, using a 10-ppm Minolta engine, actually managed 10.1 ppm, the fastest of the Text Speed test scores. The Fujitsu also took second place on our Graphics Speed test, producing 3.1 graphics pages per minute. Of the 8-ppm printers, the HP LaserJet 4 and 4M turned in the second-fastest performance on our PCL-mode Text Speed tests (just behind the Okidata OL810 LED Page Printer), while the 8-ppm Samsung Finalé 8000 bested all competitors on our

Hi-Res? No, Better Halftones

by Mary Kathleen Flynn

When Hewlett-Packard introduced the HP LaserJet III two years ago, everyone loved the crisp text and line art produced by HP's Resolution Enhancement Technology (RET). Many vendors have since copied HP, and RET clones are no big deal. Now, halftone images are getting kudos, thanks to approaches similar to RET.

The way to improve text and line art is to make them smoother. RET and its imitators accomplish this by modulating the laser beam. But to improve photographic images (called halftones or, more informally, gray scales), you have to sharpen them. The new technologies also achieve this by modulating the laser beam—with shorter "on" periods and smaller dots.

The result is that halftones look as if they were printed at resolutions higher than the standard 300 dots per inch. And indeed, to promote their halftone enhancers, vendors claim higher *perceived* resolutions.

Acer was first to market with a halftone enhancer when it brought out the Acer Laser IIIG, which produces 256 shades of gray. But Apple's PhotoGrade, which debuted late last year in the Apple LaserWriter IIg, is probably the best known. PhotoGrade lets you print in more than 65 levels of gray for a simulated resolution of 800 dpi. (If you add memory to the Apple LaserWriter IIf, you can also take advantage of PhotoGrade.)

LaserMaster, known for its innovative TurboRes technology (which varies the height of individual dots to boost effective vertical resolution), has a halftone enhancer. TurboGray produces 256 shades of gray for simulated 800-dpi gray scale images in LaserMaster's Unity 1000 and 1200xl printers.

Level 1 of NewGen's Image Enhancement Technology (IET) is an RET clone, but Level 2 is also a halftone enhancer that produces 101 shades of gray in the NewGen TurboPS/660 and 179 shades in the TurboPS/880. Okidata uses the same kind of approach with its new LED printer, the OL810 LED Page Printer. Oki Smoothing Technology enhances characters, graphics, and gray-scale patterns. Using four dot sizes, the new high-frequency LED produces a resolution approximating 300 by 1,200 dpi, with 16 shades of gray.

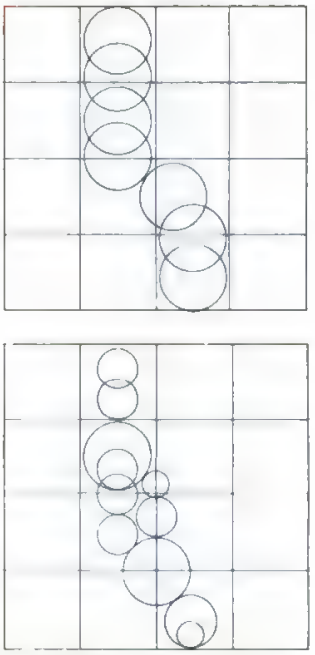
Xante, which formerly only manufactured controllers, includes gray-scale technology in its first printer, the Accel-a-Writer 8000. With 197 shades of gray, Xante claims a perceived resolution of 850 dpi. It also sells a $1,695 add-in board for HP LaserJets that boosts text and line art to 600 dpi and includes the gray-scale technology.

XLI Corp. sells the $1,495 LaserPix 3.0 LaserJet add-in board for Windows that delivers simulated 2,400-dpi images with 256 shades of gray; a version that includes true 1,200-dpi text, the LaserPix 4.0, costs $1,950.

More halftone enhancers are coming. Samsung's $995 ImageResolution Kit for its Samsung Finalé 8000, now due for release, will include a gray-scale technology along with true 600-dpi capability and an RET clone.

Destiny Technology, the leading controller maker, recently brought out a single-chip controller that extends its Edge Enhancement Technology for text and line art to halftones. Printers using the chip are expected soon. □

Smaller Dots, Shorter Ons



By modulating the laser beam and using variable-size dots, laser controller vendors can sharpen photographic images and boost perceived resolutions.

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MICROSOFT WINDOWS. SB MPC Multimedia PC

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COMDEX/Fall '92 Sands Convention Center Booth #3222
Ballys MultiMedia Showcase Booth #B910

CIRCLE 086 ON READER SERVICE CARD

Apple LaserWriter IIf — $3,299

8-ppm Canon SX engine-based laser printer with Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 7.1 ppm
PCL Graphics Speed: 0.2 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 min. 13 sec.
CorelDRAW (Direct): 2 min. 0 sec.
CorelDraw (File): N/A

PS Text Speed: 7.1 ppm
PS Graphics Speed: N/A

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 52 sec.
CorelDRAW (Direct): 13 min. 26 sec.
CorelDRAW (File): N/A

Times
Helvetica
Palatino
Courier

Apple LaserWriter IIg — $4,299

8-ppm Canon SX engine-based laser printer with Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 7.1 ppm
PCL Graphics Speed: 0.2 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 min. 12 sec.
CorelDRAW (Direct): 2 min. 0 sec.
CorelDRAW (File): N/A

PS Text Speed: 7.4 ppm
PS Graphics Speed: N/A

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 51 sec.
CorelDRAW (Direct): 13 min. 26 sec.
CorelDRAW (File): N/A

Times
Helvetica
Palatino
Courier

Apple Personal LaserWriter NTR — $2,199

4-ppm Canon LX engine-based laser printer with Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 3.9 ppm
PCL Graphics Speed: 0.7 gppm

PCL WINDOWS APPLICATIONS
Word for Windows: 2 min. 51 sec.
CorelDRAW (Direct): 1 min. 34 sec.
CorelDRAW (File): 1 min. 21 sec.

PS Text Speed: 4.0 ppm
PS Graphics Speed: 0.5 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 2 min. 45 sec.
CorelDRAW (Direct): 1 min. 44 sec.
CorelDRAW (File): 1 min. 51 sec.

Times
Helvetica
Courier Bold
Palatino Bold

Brother HL-4Ve — $1,595

4-ppm Canon LX engine-based laser printer with HP PCL 5; BR-Script PostScript Level 1 interpreter, $1,595

PCL Text Speed: 4 ppm
PCL Graphics Speed: 1.8 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 min. 49 sec.
CorelDRAW (Direct): 1 min. 10 sec.
CorelDRAW (File): 0 min. 49 sec.

Brougham
Utah
Tennessee
Brussels

Brother HL-10V — $1,995

10-ppm Brother HL-10V engine-based laser printer with HP PCL 5; BR-Script PostScript Interpreter, $399

PCL Text Speed: 9.0 ppm
PCL Graphics Speed: 2.9 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 34 sec.
CorelDRAW (Direct): 0 min. 53 sec.
CorelDRAW (File): 0 min. 31 sec.

Brougham
Courier
Letter Gothic
Times

The World Standard

First Edition ★★★★★ Everything you've been missing

HIDDEN PLOTS DISCOVERED

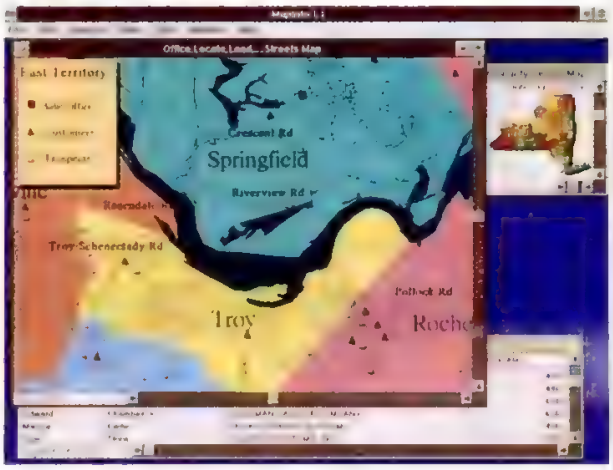
Desktop Mapping Held Responsible

For years organizations have had to rely on spreadsheets and other data analysis techniques to interpret information. But apparently, they've been missing a lot. The new technology of desktop mapping is revealing just how much.

As spokesmen at MapInfo,® the leader in desktop mapping, put it: "By advancing relational database technology to incorporate data with maps, MapInfo has produced a breakthrough in analysis capabilities. It is literally 'showing' its users patterns, relationships and trends that they never knew existed.

"In the process, it's allowing them to understand and present information more quickly, clearly and thoroughly. It's helping them deploy their resources more realistically and profitably. It's showing them how to target customers, service territories and optimize sales. It's helping them plan land use, select site locations, and efficiently manage facilities and operations.

"In a word, it's allowing them to visualize and take advantage of options and opportunities that other data analysis techniques simply can't show."



With MapInfo, you can overlay data from dBASE (DBF), Lotus 1-2-3, Excel, delimited ASCII, plus many other formats, and relate it to thousands of maps, down to street level on Windows, DOS, Macintosh, Sun and HP.

Free Demo Disk Tells Inside Story

It's called *Desktop Mapping The MapInfo Way.* Our reviewers call it the premier guide to discovering what's hidden inside your data.

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CIRCLE 291 ON READER SERVICE CARD

C. Itoh ProWriter Desktop Laser Printer CI-8 — $2,395

8-ppm TEC 1323D engine-based laser printer with HP PCL 5; Destiny PostScript Level 1 interpreter, $495

PCL Text Speed: 7.4 ppm	**PS Text Speed:** 7.4 ppm
PCL Graphics Speed: 2.7 gppm	**PS Graphics Speed:** 0.7 gppm
PCL WINDOWS APPLICATIONS:	**PS WINDOWS APPLICATIONS**
Word for Windows: 1 min. 44 sec.	**Word for Windows:** 1 min. 45 sec.
CorelDRAW (Direct): 0 min. 48 sec.	**CorelDRAW (Direct):** 1 min. 36 sec.
CorelDRAW (File): 0 min. 24 sec.	**CorelDRAW (File):** 1 min. 30 sec.

Times
Helvetica
Courier Bold
Palatino

C. Itoh ProWriter Desktop Laser Printer CI-8E — $1,695

8-ppm TEC 1323CE engine-based laser printer with HP PCL 5; Destiny PostScript Level 1 interpreter, $495

PCL Text Speed: 7.5 ppm	**PS Text Speed:** 6.4 ppm
PCL Graphics Speed: 3.0 gppm	**PS Graphics Speed:** 0.3 gppm
PCL WINDOWS APPLICATIONS:	**PS WINDOWS APPLICATIONS:**
Word for Windows: 1 min. 30 sec.	**Word for Windows:** 3 min. 28 sec.
CorelDRAW (Direct): 0 min. 47 sec.	**CorelDRAW (Direct):** 3 min. 21 sec.
CorelDRAW (File): 0 min. 23 sec.	**CorelDRAW (File):** 3 min. 18 sec.

Times
Helvetica
Courier Bold
Palatino

Epson ActionLaser II — $999

6-ppm Ricoh LP1200 engine-based laser printer with HP PCL 4; Adobe PostScript, $649

PCL Text Speed: 6 ppm	**PS Text Speed:** 5.5 ppm
PCL Graphics Speed: 1.5 gppm	**PS Graphics Speed:** 0.4 gppm
PCL WINDOWS APPLICATIONS:	**PS WINDOWS APPLICATIONS:**
Word for Windows: 1 min. 51 sec.	**Word for Windows:** 2 min. 36 sec.
CorelDRAW (Direct): 1 min. 3 sec.	**CorelDRAW (Direct):** 2 min. 37 sec.
CorelDRAW (File): 0 min. 40 sec.	**CorelDRAW (File):** 2 min. 32 sec.

Courier

Epson EPL-8000 — $1,999

10-ppm Minolta NC-10 engine-based laser printer with HP PCL 5; Adobe PostScript, $649

PCL Text Speed: 9.9 ppm	**PS Text Speed:** 7.4 ppm
PCL Graphics Speed: 2.1 gppm	**PS Graphics Speed:** .5 gppm
PCL WINDOWS APPLICATIONS:	**PS WINDOWS APPLICATIONS:**
Word for Windows: 1 min. 18 sec.	**Word for Windows:** 2 min. 9 sec.
CorelDRAW (Direct): 0 min. 58 sec.	**CorelDRAW (Direct):** 2 min. 2 sec.
CorelDRAW (File): 0 min. 36 sec.	**CorelDRAW (File):** 2 min. 4 sec.

Roman
Roman-T Bold
Sans-U Normal
Courier Bold

Fujitsu Print Partner 10 — $1,995

PC MAGAZINE EDITORS' CHOICE

10-ppm Minolta SP10 engine-based laser printer with HP PCL 5; Microsoft TrueImage PostScript interpreter, $499

PCL Text Speed: 10.1 ppm	**PS Text Speed:** 8.3 ppm
PCL Graphics Speed: 3.1 gppm	**PS Graphics Speed:** 0.8 gppm
PCL WINDOWS APPLICATIONS:	**PS WINDOWS APPLICATIONS:**
Word for Windows: 1 min. 7 sec.	**Word for Windows:** 1 min. 40 sec.
CorelDRAW (Direct): 0 min. 46 sec.	**CorelDRAW (Direct):** 1 min. 17 sec.
CorelDRAW (File): 0 min. 25 sec.	**CorelDRAW (File):** 1 min. 14 sec.

Courier
Univers
Times Roman
Palatino

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†Source: Toshiba retail price as of 8/24/92. ◊Leasing arranged by Leasing Group, Inc. i386 and the Intel Inside Logo are trademarks of Intel Corporation. MS-DOS is a registered trademark of Microsoft Corporation. FORTUNE 500 is a registered trademark of The Time Inc. Magazine Company. Dell disclaims proprietary interest in the marks and names of others. ©1992 Dell Computer Corporation. All rights reserved

HP LaserJet 4 — $2,199

8-ppm Canon P-270 engine-based laser printer with 600-dpi output, enhanced HP PCL 5; Adobe PostScript Level 2, $499

PCL Text Speed: 7.9 ppm
PCL Graphics Speed: 2.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 31 sec.
CorelDRAW (Direct): 0 min. 49 sec.
CorelDRAW (File): 0 min. 23 sec.

CG Times
Univers
Arial
Courier Bold

HP LaserJet 4M — $2,999

8-ppm Canon P-270 engine-based laser printer with 600-dpi output, Adobe PostScript Level 2, enhanced HP PCL 5

PCL Text Speed: 7.9 ppm
PCL Graphics Speed: 2.5 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 29 sec.
CorelDRAW (Direct): 0 min. 47 sec.
CorelDRAW (File): 0 min. 25 sec.

PS Text Speed: 7.9 ppm
PS Graphics Speed: 0.8 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 39 sec.
CorelDRAW (Direct): 0 min. 46 sec.
CorelDRAW (File): 1 min. 9 sec.

CG Times
Univers
Palatino
Courier

HP LaserJet IIP Plus — $1,249

4-ppm Canon LX engine-based laser printer with HP PCL 4; Adobe PostScript Level 1, $495; HP PCL 5, $299

PCL Text Speed: 4.0 ppm
PCL Graphics Speed: 1.8 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 3 min. 0 sec.
CorelDRAW (Direct): 0 min. 55 sec.
CorelDRAW (File): 0 min. 35 sec.

Courier
LinePrinter

Kyocera Ecosys a-Si Printer FS-1500A — $2,395

10-ppm Ecosys engine-based laser printer with HP PCL 5; Kyocera PostScript interpreter, $399

PCL Text Speed: 9.3 ppm
PCL Graphics Speed: 2.2 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 25 sec.
CorelDRAW (Direct): 1 min. 2 sec.
CorelDRAW (File): 0 min. 38 sec.

Dutch Roman
Swiss Roman
Courier
Letter Gothic

LaserMaster Unity 1000 — $6,995

8-ppm Canon SX engine-based laser printer with 1,000-dpi output, HP PCL 4, enhanced TrueImage PostScript emulator

PCL Text Speed: 7.0 ppm
PCL Graphics Speed: 2.3 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 38 sec.
CorelDRAW (Direct): 0 min. 46 sec.
CorelDRAW (File): 0 min. 25 sec.

PS Text Speed: 7.5 ppm
PS Graphics Speed: 1.1 gppm

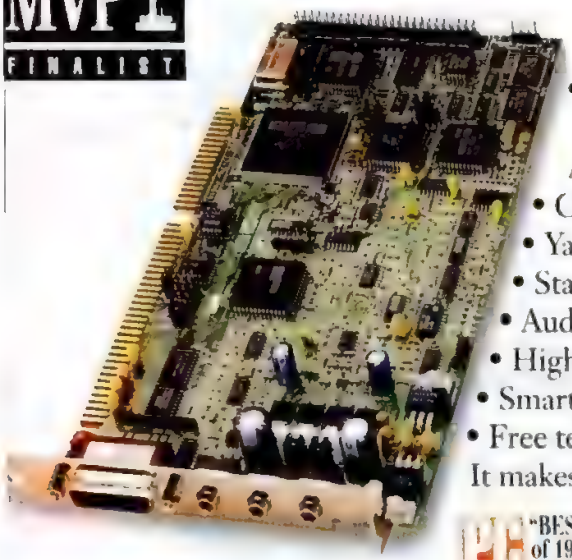
PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 31 sec.
CorelDRAW (Direct): 1 min. 8 sec.
CorelDRAW (File): 1 min. 3 sec.

Times
Helvetica
Courier Bold
Palatino

THERE ARE STILL A FEW PEOPLE WHO HAVEN'T BOUGHT PRO AUDIOSPECTRUM 16.

PC Computing MVP 92 FINALIST

Wild as it sounds, Pro AudioSpectrum 16™ is the #1 16-bit sound card in the world — outselling all other sound cards, practically overnight. And here are just a few of the reasons why:



- True 16-bit CD quality stereo audio record/playback at up to 44kHz.
- Fully compatible with the largest library of software including Sound Blaster™, Microsoft Windows 3.1®, Business Audio and MPC.
- CD-ROM ready via a built-in SCSI interface.
- Yamaha OPL3 20 voice stereo synthesizer.
- State-of-the-art audio mixer with 4 watt per channel amplifier.
- Audio compression/decompression.
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- Free technical support.

It makes any other solution seem totally primitive.

MICROSOFT WINDOWS COMPATIBLE

PC MAGAZINE "BEST of 1991" Robert Kendall Pro AudioSpectrum Review 12/10/91

PC Multimedia PC

MEDIA VISION

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CIRCLE 093 ON READER SERVICE CARD

LaserMaster Unity 1200xl — $9,995

8-ppm Toshiba TN-7270 engine-based laser printer with 1,200-dpi output, HP PCL 4, enhanced TrueImage PostScript emulator

PCL Text Speed: 4.4 ppm
PCL Graphics Speed: 2.1 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 min. 33 sec.
CorelDRAW (Direct): 0 min. 48 sec.
CorelDRAW (File): 0 min. 32 sec.

PS Text Speed: 8.2 ppm
PS Graphics Speed: 0.9 gppm

PS WINDOWS APPLICATIONS
Word for Windows: 1 min. 42 sec.
CorelDRAW (Direct): 0 min. 56 sec.
CorelDRAW (File): 1 min. 1 sec.

Times
Helvetica
Courier Bold
Palatino

LaserMaster WinPrinter 800 — $1,595

4-ppm Canon LX engine-based laser printer with 800 dpi-output, HP PCL 4, enhanced TrueImage PostScript emulator

PCL WINDOWS APPLICATIONS:
Word for Windows: 3 min. 13 sec.
CorelDRAW (Direct): 1 min. 5 sec.
CorelDRAW (File): 0 min. 58 sec.

PS WINDOWS APPLICATIONS:
Word for Windows: 5 min. 3 sec.
CorelDRAW (Direct): 2 min. 6 sec.
CorelDRAW (File): 3 min. 27 sec.

Times
Helvetica
Courier
Courier Bold

IBM LaserPrinter 6P — $2,295

6-ppm Lexmark engine-based laser printer capable of 600-dpi output, with Adobe PostScript, HP PCL 4; HP PCL 5, $199

PCL Text Speed: 5.8 ppm
PCL Graphics Speed: 1.8 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 min. 21 sec.
CorelDRAW (Direct): 0 min. 53 sec.
CorelDRAW (File): 0 min. 33 sec.

PS Text Speed: 5.5 ppm
PS Graphics Speed: 0.4 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 2 min. 47 sec.
CorelDRAW (Direct): 2 min. 20 sec.
CorelDRAW (File): 2 min. 15 sec.

Times
Helvetica
Helvetica Narrow
Courier Bold

IBM LaserPrinter 10P — $3,795

PC MAGAZINE EDITORS' CHOICE

10-ppm Lexmark engine-based laser printer with 600-dpi output, Adobe PostScript, HP PCL 4; HP PCL 5, $199

PCL Text Speed: 9.1 ppm
PCL Graphics Speed: 2.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 21 sec.
CorelDRAW (Direct): 0 min. 43 sec.
CorelDRAW (File): 0 min. 30 sec.

PS Text Speed: 8.8 ppm
PS Graphics Speed: 0.7 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 38 sec.
CorelDRAW (Direct): 1 min. 16 sec.
CorelDRAW (File): 1 min. 21 sec.

Times
Helvetica
Courier Bold
Palatino

Mannesmann Tally MT908 — $1,995

8-ppm TEC 1323D engine-based laser printer with HP PCL 5; Destiny PostScript Level 1 interpreter, $599

PCL Text Speed: 7.6 ppm
PCL Graphics Speed: 2.8 ppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 29 sec.
CorelDRAW (Direct): 0 min. 46 sec.
CorelDRAW (File): 0 min. 24 sec.

PS Text Speed: 7.6 ppm
PS Graphics Speed: 0.7 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 45 sec.
CorelDRAW (Direct): 1 min. 29 sec.
CorelDRAW (File): 1 min. 23 sec.

Times
Helvetica
Courier Bold
Palatino

NEC Silentwriter Model 95 — $1,749

PC MAGAZINE EDITORS' CHOICE

6-ppm Minolta engine-based laser printer with Adobe PostScript Level 2, HP PCL 5

PCL Text Speed: 6.0 ppm
PCL Graphics Speed: 1.9 ppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 55 sec.
CorelDRAW (Direct): 0 min. 58 sec.
CorelDRAW (File): 0 min. 35 sec.

PS Text Speed: 5.8 ppm
PS Graphics Speed: 0.4 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 2 min. 37 sec.
CorelDRAW (Direct): 2 min. 32 sec.
CorelDRAW (File): 2 min. 28 sec.

Times
Helvetica
Courier Bold
Palatino

NewGen TurboPS/300p — $1,995

4-ppm Canon LX engine-based laser printer with HP PCL 4, NewGen PostScript emulator

PCL Text Speed: 3.8 ppm
PCL Graphics Speed: 0.7 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 14 min 29 sec
CorelDRAW (Direct): N/A
CorelDRAW (File): N/A

PS Text Speed: 3.8 ppm
PS Graphics Speed: 0.7 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 3 min. 27 sec.
CorelDRAW (Direct): 1 min. 20 sec.
CorelDRAW (File): 1 min. 13 sec.

Courier-Bold
Helvetica
Palatino-Bold
Times

NewGen TurboPS/400p — $2,595

4-ppm Canon LX engine-based laser printer with 400-dpi output, HP PCL 4, NewGen PostScript Level 1 emulator

PCL Text Speed: 3.9 ppm
PCL Graphics Speed: 0.7 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 11 min. 59 sec.
CorelDRAW (Direct): 1 min. 41 sec.
CorelDRAW (File): 1 min. 23 sec.

PS Text Speed: 3.8 ppm
PS Graphics Speed: 0.7 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 3 min. 9 sec.
CorelDRAW (Direct): 1 min. 22 sec.
CorelDRAW (File): 1 min. 26 sec.

Courier-Bold
Helvetica
Palatino-Bold
Times

NewGen TurboPS/630En — $3,595

8-ppm Canon SX engine-based laser printer with 600-by-300-dpi output, HP PCL 4, NewGen PostScript emulator

PCL Text Speed: 7.3 ppm
PCL Graphics Speed: 1.2 gppm

PCL WINDOWS APPLICATIONS
Word for Windows: 7 min. 47 sec.
CorelDRAW (Direct): N/A
CorelDRAW (File): N/A

PS Text Speed: 7.6 ppm
PS Graphics Speed: 0.9 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 55 sec.
CorelDRAW (Direct): 0 min. 58 sec.
CorelDRAW (File): 1 min. 29 sec.

Courier-Bold
Helvetica
Palatino-Bold
Times

NewGen TurboPS/660 — $3,495

8-ppm Canon SX engine-based laser printer with 600-dpi output, HP PCL 4, NewGen PostScript emulator

PCL Text Speed: 7.1 ppm
PCL Graphics Speed: 1.2 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 8 min 7 sec
CorelDRAW (Direct): N/A
CorelDRAW (File): N/A

PS Text Speed: 7.5 ppm
PS Graphics Speed: 0.9 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 2 min. 27 sec.
CorelDRAW (Direct): 1 min. 4 sec.
CorelDRAW (File): 1 min. 9 sec.

Courier-Bold
Helvetica
Palatino-Bold
Times

Introducing new PS/2® desktop computers with the brains and the brawn to take on your toughest jobs. Without even blinking. Heavy-mettle machines so advanced, when you get down to business, they rise above.

The new PS/2 Model 77 lets you flex maximum muscle with a double-clutch 486 DX2 66/33 MHz or powerful 486 SX/

The PS/2 Model 77 486 DX2: 66/33 MHz double-clutch processing at its best.

PS/2

33 MHz processor. Either way, you'll get enormous 400 or 212MB hardfiles. The new Model 76 also cranks out 486 SX/33 MHz power, with 212 or 104MB of storage. The latest 486SLC2 50/25 MHz technology drives the new Models 57 and 56. Both have huge 212 or 104MB hardfiles. With these new models and our state-of-the-art multimedia offerings, we offer the widest selection of the

*The three-year warranty, four-hour response, setup, usage and service assistance apply only to all newly announced IBM PS/2 machine types.
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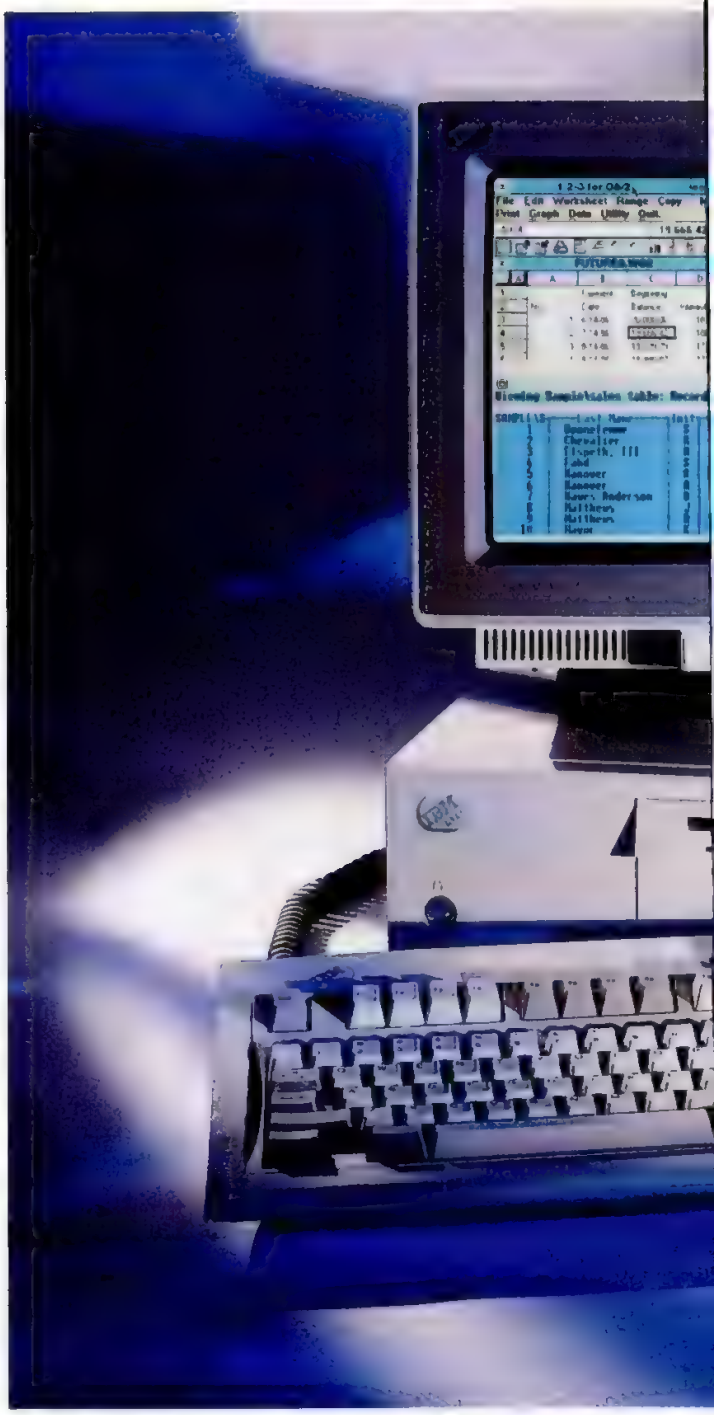
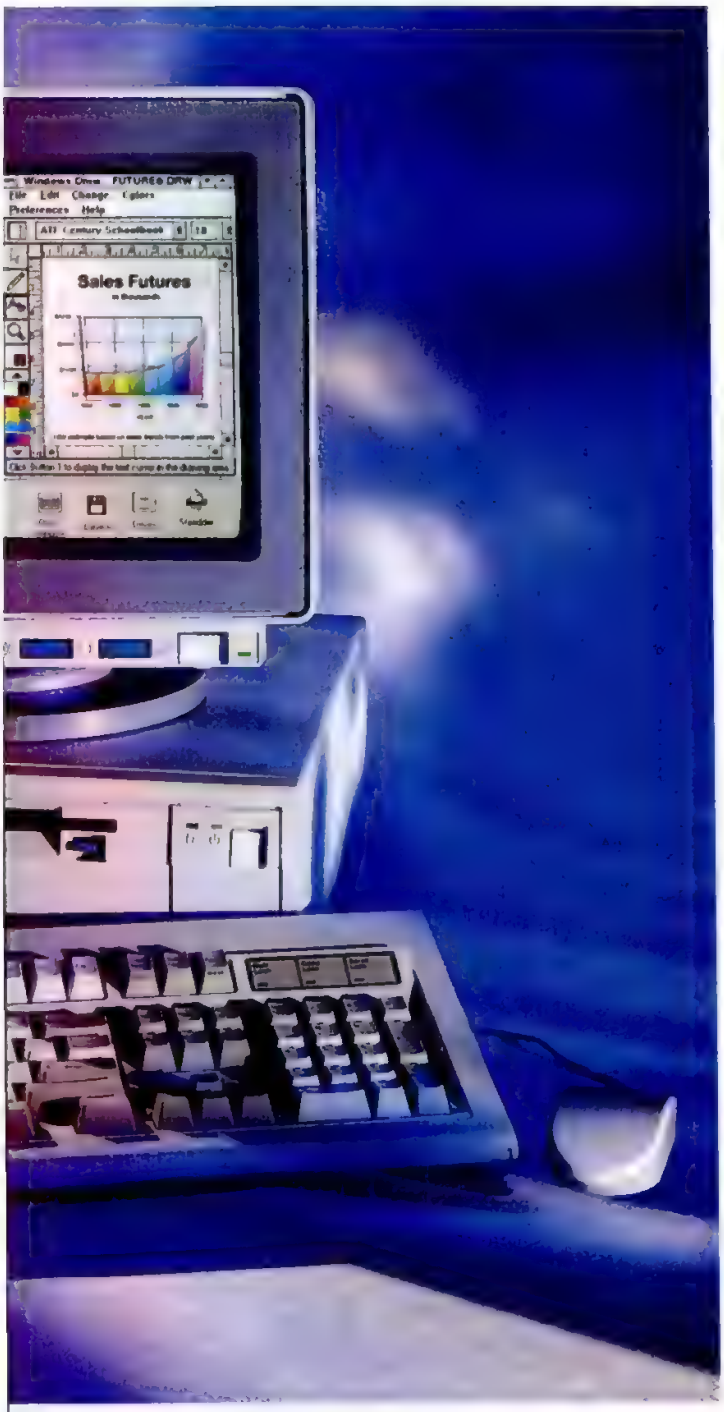


Like all new desktop PS/2s, the Model 76 has 8MB standard memory and OS/2® 2.0 pre-installed.

What other com
If they had



industry's most sophisticated 486-based computers. Bar none.

All our new PS/2s are backed by HelpWare,™ a range of service and support so complete, the competition doesn't have the guts to match it—like a three-year on-site warranty and 24-hour/seven-day-a-week assistance. We also continually test PS/2s under the worst conditions you could imagine. So when the work keeps coming, your PS/2 will keep going. And we're continuing to expand our already extensive features and options with new disk drives and processor options.

Not every line of computers can make these claims. Then again, not every computer has the guts to be a PS/2.

The HelpWare Advantage.

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Service Response Time	Next Business Day	Second Business Day	4-Hour Average**
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Trade-in Program	No	No	Yes
Licensed Education Centers	No	No	Yes
30-Day Money-Back Guarantee	Yes	No	Yes

Source: Dataquest Ledgeway, 7/92.

For more information or an IBM authorized dealer near you, call our Personal Systems HelpCenter™ at 1 800 772-2227.†

IBM

puters would be. the guts.

CIRCLE 024 ON READER SERVICE CARD

NewGen TurboPS/840e — $3,995

8-ppm Canon SX engine-based laser printer with 800- by 400-dpi output, HP PCL 4, NewGen PostScript emulator

PCL Text Speed: 7.2 ppm
PCL Graphics Speed: 1.3 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 7 min. 35 sec.
CorelDRAW (Direct): 1 min. 12 sec.
CorelDRAW (File): 0 min. 48 sec.

PS Text Speed: 7.6 ppm
PS Graphics Speed: 0.9 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 36 sec.
CorelDRAW (Direct): 1 min. 0 sec.
CorelDRAW (File): 1 min. 3 sec.

Courier-Bold
Helvetica
Palatino-Bold
Times

NewGen TurboPS/880 — $4,795

8-ppm Canon SX engine-based laser printer with 800-dpi output, HP PCL 4, NewGen PostScript Level 1 emulator

PCL Text Speed: 7.2 ppm
PCL Graphics Speed: 1.1 gppm

PCL WINDOWS APPLICATIONS
Word for Windows: 8 min. 35 sec.
CorelDRAW (Direct): 1 min. 10 sec.
CorelDRAW (File): 0 min. 56 sec.

PS Text Speed: 7.3 ppm
PS Graphics Speed: 1.1 gppm

PS WINDOWS APPLICATIONS
Word for Windows: 1 min. 45 sec.
CorelDRAW (Direct): 1 min. 59 sec.
CorelDRAW (File): 0 min. 54 sec.

Courier-Bold
Helvetica
Palatino-Bold
Times

Okidata OL810 LED Page Printer — $1,699

8-ppm OL800 engine-based laser printer with HP PCL 5

PCL Text Speed: 8.0 ppm
PCL Graphics Speed: 2.9 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 19 sec.
CorelDRAW (Direct): 0 min. 46 sec.
CorelDRAW (File): 0 min. 20 sec.

Courier
CG Times
Univers
Dutch

Panasonic KX-P4410 — $1,095

5-ppm Panasonic 4400 engine-based laser printer with HP PCL 4

PCL Text Speed: 4.5 ppm
PCL Graphics Speed: 1.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 min. 31 sec.
CorelDRAW (Direct): 1 min. 16 sec.
CorelDRAW (File): 0 min. 53 sec.

Courier
Century

Panasonic KX-P4430 — $1,495

5-ppm Panasonic 4400 engine-based laser printer with HP PCL 5

PCL Text Speed: 4.7 ppm
PCL Graphics Speed: 1.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 min. 28 sec.
CorelDRAW (Direct): 1 min. 12 sec.
CorelDRAW (File): 0 min. 49 sec.

Courier
Century
CG Times
Univers

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Take our personal microLaser Plus for example. With its high duty cycle of 10,000 pages-per-month* and a standard one-year limited warranty**, you can rely on your microLaser to work the first time, every time, for years.

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Features	microLaser Plus Basic	microLaser Plus PS17/PS35	microLaser Turbo	microLaser XL Turbo
PPM	9 ppm	9 ppm	9 ppm	16 ppm
Emulation	HP LaserJet II	HPLJII/PostScript	HPLJII/PostScript II	HPLJII/PostScript II
Processor	68000	68000	RISC/8220	RISC/8220
Fonts	14 HP Fonts	17 or 35 Scalable	35 Scalable	35 Scalable
List Price	$999	$1,399/$1,499	$1,749	$3,649

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Samsung Finale 8000 — $1,995

8-ppm Samsung F8000 engine-based laser printer with HP PCL 5, Samsung PostScript Level 1 interpreter

PCL Text Speed: 7.5 ppm
PCL Graphics Speed: 3.6 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 29 sec.
CorelDRAW (Direct): 0 min. 42 sec.
CorelDRAW (File): 0 min. 20 sec.

PS Text Speed: 7.4 ppm
PS Graphics Speed: 0.7 gppm
PS WINDOWS APPLICATIONS
Word for Windows: 1 min. 37 sec.
CorelDRAW (Direct): 1 min. 24 sec.
CorelDRAW (File): 1 min. 20 sec.

Times
Helvetica
Courier Bold
Palatino

TI microLaser Turbo — $1,749

9-ppm Sharp JX-9500 engine-based laser printer with Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 8.3 ppm
PCL Graphics Speed: 1.8 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 25 sec.
CorelDRAW (Direct): 0 min. 57 sec.
CorelDRAW (File): 0 min. 34 sec.

PS Text Speed: 8.4 ppm
PS Graphics Speed: 0.8 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 35 sec.
CorelDRAW (Direct): 1 min. 19 sec.
CorelDRAW (File): 1 min. 15 sec.

Times
Helvetica
Palatino
Courier

Toshiba PageLaser GX200 — $1,799

8-ppm TEC LB-1323 engine-based laser printer with HP PCL 5; Toshiba PostScript Level 1 interpreter, $699

PCL Text Speed: 7.6 ppm
PCL Graphics Speed: 3.0 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 30 sec.
CorelDRAW (Direct): 0 min. 46 sec.
CorelDRAW (File): 0 min. 22 sec.

PS Text Speed: 6.6 ppm
PS Graphics Speed: 0.4 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3 min. 47 sec.
CorelDRAW (Direct): 2 min. 47 sec.
CorelDRAW (File): 2 min. 44 sec.

CG Times
Courier
Helvetica
Palatino

Xante Accel-a-Writer 8000 — $3,295

8-ppm Canon SX engine-based laser printer with 600-dpi output, HP PCL 4, Phoenix PostScript interpreter

PCL Text Speed: 7.7 ppm
PCL Graphics Speed: 2.1 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 30 sec.
CorelDRAW (Direct): 0 min. 46 sec.
CorelDRAW (File): 0 min. 29 sec.

PS Text Speed: 7.5 ppm
PS Graphics Speed: 0.9 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 46 sec.
CorelDRAW (Direct): 1 min. 12 sec.
CorelDRAW (File): 1 min. 8 sec.

Courier
Helvetica
Times
Palatino

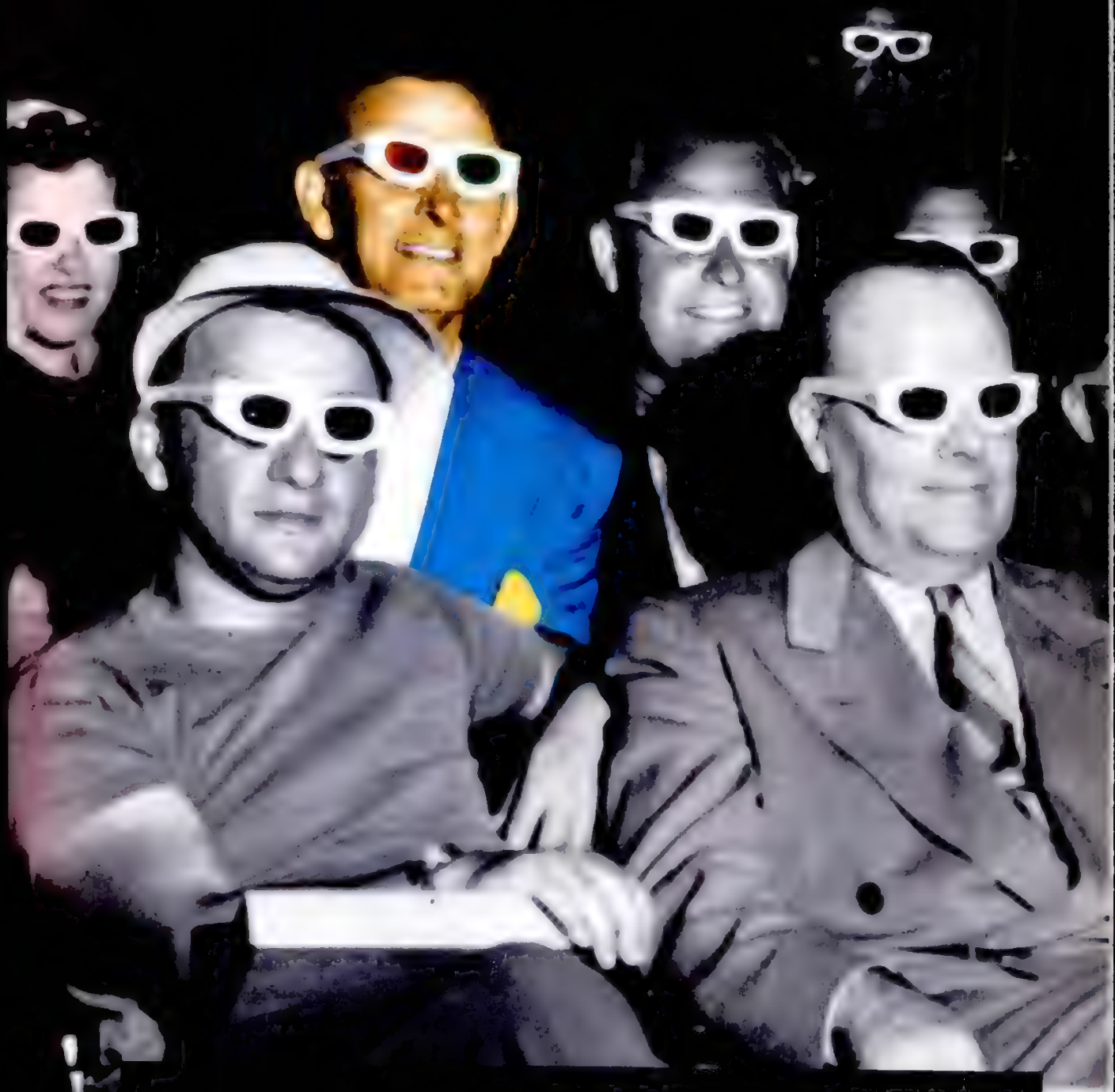
Graphics Speed test in PCL mode.

All the NewGen printers failed our PCL 4 Torture Test; not surprisingly, they were some of the most disappointing performers in PCL mode. All had particular difficulty with the Graphics Speed test in PCL mode. Because of their PCL incompatibilities, the TurboPS/300p, TurboPS/630En, and TurboPS/660 were incapable of printing either CorelDRAW file on our PCL-mode CorelDRAW test. On our PCL-mode Word for Windows test, the six NewGen systems took anywhere from 7 to over 14 minutes—longer than any other printer in this roundup. NewGen says it is looking into the problem.

Despite their slower serial connections, the 8-ppm Apple LaserWriter IIf ($3,299) and LaserWriter IIg ($4,299) performed adequately—if a little slowly for their class—on our PCL-mode Text Speed test. But the units crawled on our Graphics Speed test, with scores of 0.2 gppm. The Apple IIg also failed our PostScript Level 2 compatibility test.

On our PostScript Text Speed test, the 10-ppm IBM LaserPrinter 10P's 8.8-ppm score proved fastest. The 10-ppm Epson EPL-8000 ($1,999), which stood out as the second-fastest performer on our PCL Text Speed test (9.9 ppm), fell behind in PostScript mode (7.4 ppm).

In PostScript mode, the HP LaserJet 4M came out ahead of the 8-ppm competition, with a score of 7.9 ppm. The To-



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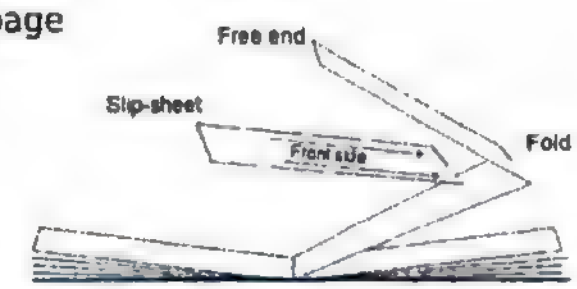
Folded edge of the page

GbsSlipSheet-001

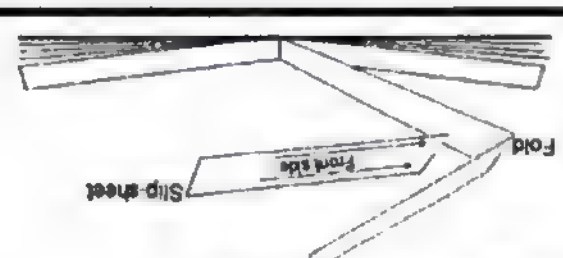
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



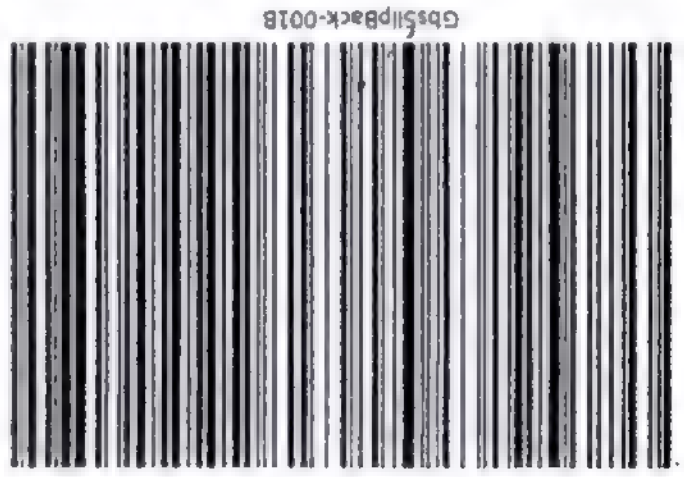
Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

1. Follow instructions on the other side



Back

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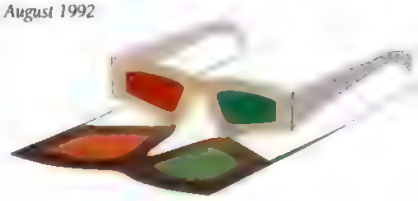
PC Sources, August 1992

Just one more reason why EPS is the wise choice.



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shiba PageLaser GX200 ($1,799) and the C. Itoh ProWriter Desktop Laser Printer CI-8E ($1,695), which both use an 8-ppm TEC engine, produced slow scores of 6.6 ppm and 6.4 ppm, respectively. The only other real disappointment was the LaserMaster Unity 1200xl. Though rated at 8 ppm when printing portrait files in landscape mode (a mode that worked only in PostScript on the tested unit), it plodded along at 6.2 ppm.

On our PostScript-mode Graphics Speed test, most units performed slowly. Under PostScript, a file must be read and interpreted prior to printing; with complex graphics images, the time this takes increases dramatically. The 8-ppm LaserMaster Unity 1000 and NewGen TurboPS/880, each with a score of 1.1 gppm, took the lead here; the LaserMaster Unity 1200xl, Xante Accel-a-Writer 8000, and the other three 8-ppm NewGen systems were close seconds at 0.9 gppm.

Interestingly, considering their primary orientation as PostScript printers, the Apple IIg and IIf were unable to perform our PostScript-mode Graphics Speed test. These units were also unable to complete the Print from File version of our CorelDRAW test in both PostScript and PCL modes, suggesting some DOS compatibility problems. The company was unable to resolve the issue.

HOOKING UP

The printers reviewed in this section probably aren't the best options for large networks. But they do offer more connectivity options than ever before, making them fine choices for small- or medium-size workgroup printing. HP, for example, offers its own JetDirect network interface cards for the LaserJet 4 and 4M, and those printers can also use Extended Systems' (Boise, Idaho; 208-322-7575) line of network interfaces, printer-sharing devices, and fax products. Other companies that offer or plan to offer Ethernet or Token-Ring interfaces (or both) are Apple, Kyocera, LaserMaster, Lexmark, NEC, NewGen, Samsung, and Toshiba.

AppleTalk and SCSI ports—the former useful in mixed environments, the latter handy for storing graphics files or fonts on a hard disk—have grown quite common. The Summary of Features and product reviews will tell you which printers offer them as standard equipment or as options. If you're likely to use more than one port, be sure the printer includes automatic interface switching.

If you plan to use your printer in a workgroup situation, you should look for automatic emulation switching. QMS was the first vendor to achieve this gracefully; the most elegant solutions are those that require no user intervention, but software that lets you switch emulations without going to the control panel is an acceptable alternative.

NEW AND NOTEWORTHY

On the new side, watch for printers from Bull Compuprint (the PageMaster 1021), Sharp Electronics (the Sharp JX-9600 and JX-9600PS), and Personal Computer Products (the LaserImage 400 and LaserImage 800). These were not available for this review but were either shipping at press time or should ship this quarter. (Packard Bell's PB9815 was shipping at review time, but the company was unable to provide a unit.)

Among the products here, a few special features, though not widely implemented, are worth mentioning. Epson's EPL-8000, for example, is the first printer we've seen to sport a PCMCIA slot. In fact, it's got two of the credit card–size PCMCIA expansion slots, which are popular these days in notebook computers. The Epson provides these for font cards, but (like many PCMCIA peripherals) none are available yet.

Kyocera figured out how to make a photoconductor system that never has to be replaced. That means its Ecosys a-Si Printer FS-1500A is good not only for the environment—there are no toner cartridges to throw away—but also for you. This approach lowers the operating cost to less than 1 cent per page, compared with a cost of 2 to 3 cents for most printers that use traditional photoconductor systems.

And NEC has made it possible to turn

▪ Moving On Up to PCL 5

by M. David Stone

Even if budget constraints won't let you replace your HP LaserJet Series II or other printer with an HP LaserJet III compatible, you may still be able to afford an upgrade to HP PCL 5. For $129, LaserTwin 5.0, from Metro Software (Tucson, Arizona; 602-292-0313), provides an inexpensive software alternative.

LaserTwin 5.0 is a TSR that intercepts print data and converts it from PCL 5 to whatever format your printer uses, supplying it with PCL 5 features such as scalable fonts in the process. The program lists about 550 printers in its setup menus, including choices for PCL 4, PostScript, and Canon native-mode laser printers; Canon and HP ink jet printers; and Epson and IBM dot matrix printers. LaserTwin needs about 2.3MB to 3MB of disk space for its files but only 27K of conventional memory (or you can load it high).

On PC Magazine Labs' PCL 5 Torture Test, LaserTwin printed without problems to Canon, PCL 4, and PostScript printers. The program does not, however, support the HPGL command set incorporated in PCL 5.

By the time this is published, BetterYet IV, from Output Technology (Spokane, Washington; 509-536-0468), should also be available. This $999 package consists of a board and cartridge that emulate both PostScript and PCL 5. It installs in the HP LaserJet II *and* the LaserJet III. Even if you already own a LaserJet III and aren't interested in PostScript, the product's claimed ability to speed print processing in either mode may spark your interest.

Output Technology is also developing BetterYet IV Special Edition, a similar package that includes PCL 5 only (pricing for this product has not yet been finalized, but it will probably cost under $800), and BetterYet III, a $299 PCL 5 cartridge for the HP LaserJet II.

You can still get some good years out of your PCL 4 or other printer. And although you will shortly have several options for upgrading to PCL 5, the $129 LaserTwin is the most cost-efficient choice. □

the Silentwriter Model 95 into a PostScript fax machine. The optional internal plain-paper fax/modem ($599) supports both the sending and receiving of standard 200-dpi Group III facsimiles. (A similar capability can be found in the Compaq PageMarq printers, reviewed in the shared laser printer section.)

If all these features don't tempt you to buy a new laser printer, perhaps the prices will. According to Computer Intelligence, the La Jolla, California–based market research house, prices for low-end printers (6 ppm and slower) have dropped 9 percent over the last year. Among the 6-ppm or slower price-busters in this review are the $999 Epson ActionLaser II (priced at about $700 on the street) and the $1,095 Panasonic KX-P4410, which can be found for under $1,000. You can also pick up the HP LaserJet IIP Plus for about $850 on the street.

High-end printers (10 ppm or more) have dropped in price about 4 percent this year. In this review, three of the five 10-ppm units listed for under $2,000, not including PostScript options. Equipped with PostScript, two still come in under $2,500, and the third costs just slightly more. For 8- to 9-ppm printers, prices have gone down less than 1 percent, but you can still find some real bargains. For example, the 9-ppm TI microLaser Turbo costs $1,749 (including Adobe PostScript Level 2), and the Okidata OL810 8-ppm printer is available for $1,699—and closer to $1,400 on the street.

As you'll see in the reviews that follow, the feature set for most lasers has expanded considerably. Today's buyers are clearly going to get more for their money.

Apple Computer Inc.

Apple LaserWriter IIf
Apple LaserWriter IIg
Apple Personal LaserWriter NTR

BY EDWARD MENDELSON

The PC-Mac cold war may not be over, but one sign of detente is the way that Apple Computer's new laser printers incorporate features that should make them more compatible with DOS-based machines than before. Apple's newest offerings are the 8-page-per-minute Apple LaserWriter IIf ($3,299) and Apple LaserWriter IIg ($4,299), and the 4-ppm Apple Personal LaserWriter NTR ($2,199). As the first Apple printer to include a parallel port, the LaserWriter NTR serves as the line's chief ambassador to the IBM PC–compatible world.

All three include Adobe PostScript Level 2 and HP PCL 4. But some walls still stand between the Apple and PC worlds. None of the three are fully HP-compatible, and our inability to get results for the IIf and IIg on some PCL and PostScript tests indicates that these two aren't fully able to speak the language of the DOS world.

Apple LaserWriter IIf, Apple LaserWriter IIg, Apple Personal LaserWriter NTR

TOP OF THE LINE

Apple's top-of-the-line LaserWriter IIf and LaserWriter IIg use the familiar 300-dpi Canon SX engine found in the HP LaserJet III. Both also include Apple's FinePrint, which provides results similar to HP's Resolution Enhancement Technology. A 68030 processor runs at 25 MHz in the IIg and at 20 MHz in the IIf. The IIf and IIg each come standard with one 200-sheet tray for letter-size paper.

The IIf, which you can find for around $2,800, is designed as an affordable, networkable printer with its serial and AppleTalk connections. The IIg adds an EtherTalk connection, and carries a hefty street price of $3,499. Designed as an advanced printer for graphics use, the IIg comes with 8MB of RAM and Apple's PhotoGrade technology, which lets you print in more than 65 levels of gray with an effective resolution of 800 dpi. The IIf includes 4MB; adding another 4MB automatically activates PhotoGrade. (Both models are upgradable to 32MB using standard Macintosh-style SIMMs.)

Both models produce superb 300-dpi PostScript output, but even with PhotoGrade, the IIg's output didn't approach the 600-dpi PostScript output of the HP LaserJet 4M.

With all its printers, Apple gives you a Macintosh driver but no PC software. You can, however, use Windows' LaserWriter IINTX driver instead. And you won't need special software to use PhotoGrade; most desktop publishing or photo-editing applications will use it automatically if they support gray-scale adjustments.

Both printers omit the ITC Zapf Dingbats found in the standard 35 built-in PostScript fonts; if you select this font in your applications, you'll get Courier instead. To get Zapf Dingbats, download a copy before printing.

The IIf and IIg also include Apple's TrueType font rasterizer, but you can't download TrueType fonts directly to either printer from the PC. (This is also true for the NTR.)

Apple's PCL 4 mode, provided by Adobe, isn't fully compatible with HP models. Justified text designed for HP's Helv and TmsRmn fonts sometimes printed with a slightly ragged edge. Apple could not tell us which codes would access the high-order ASCII characters in the standard IBM character set, and some characters used by HP's Roman-8 character set aren't available at all.

Apple reports LaserJet IIP compatibility for these printers, but they don't support the compressed graphics feature that is the main distinction between the LaserJet IIP and the LaserJet II.

Both printers include a serial port; PC users will normally communicate with them at up to 19,200 bps via the serial port, which is slower than the parallel connection used by all the other printers in this review. PC Magazine Labs' tests, however, are conducted at only 9,600 bps on serial connections. In PCL mode, both printers managed 7.1 ppm on our Text

Photographs by Thom O'Connor

Speed test, but were the slowest on our Graphics Speed test, with scores of 0.2 graphics pages per minute. Their CorelDRAW (Direct Print) scores in PCL mode, at 2 minutes each, were also the slowest of the group, and they were unable to perform the Print from File version of the CorelDRAW test.

More surprising were the printers' inability to perform both the Graphics Speed and CorelDRAW (Print from File) tests in PostScript mode, and the IIg's inability to perform our PostScript Level II compatibility test. And both took over 13 minutes in PostScript mode to print the CorelDRAW file when output directly to the printer. Apple was unable to provide a solution to the printing problems.

Apple's PhotoGrade lets you print in more than 65 levels of gray with an effective resolution of 800 dpi.

PERSONAL LASERWRITER NTR

The compact Personal LaserWriter NTR—available on the street for around $1,700—uses the same 300-dpi Canon LX engine found in the LaserJet IIP and IIIP. It includes a 70-sheet capacity tray for letter- and legal-size paper. You can supplement that with the same optional 250-sheet lower tray available for HP and similar models ($199 from Apple).

The NTR uses the Canon engine without resolution or halftone enhancements. Under PCL 4 mode, it demonstrated the same HP incompatibilities and ragged-edge problems of the higher-end models.

The NTR uses a 16-MHz AMD 29005 RISC processor and comes with 3MB, expandable to 4MB with a standard IBM-style SIMM.

When connected to its parallel port, the NTR generally performed well for a 4-ppm printer in PCL and PostScript text emulation: 3.9 and 4.0 ppm. Its PCL graphics score of 0.7 ppm lagged behind the HP IIP Plus and Brother HL-4Ve.

Since the Macintosh is designed for two-way communication with the printer, neither the NTR nor the other Apple printers include the control panel found on most HP-compatible models. The only indicators on the printer are lights that indicate low toner, paper jams, paper out, and data processing.

In their respective classes, all three Apple printers are more costly and less flexible than many printers designed for the PC market. Consider them if you have a solitary PC in an environment of networked Macs (particularly if PostScript Level 2 is important to you). Otherwise, look elsewhere.

Apple Computer Inc., *20525 Mariani Ave., Cupertino, CA 95014; 800-776-2333, 408-996-1010.*

Apple LaserWriter IIf *List price: $3,299; 4MB RAM upgrade, $229; 200-sheet letter- or legal-size paper cassette, $79 each; envelope cassette, $89; toner cartridge, $99. Dimensions (HWD): 8.6 x 20 x 18.5 inches. Weight: 45 pounds. Emulations: Adobe PostScript Level 2, HP PCL 4.*

Apple LaserWriter IIg *List price: $4,299; same options as for the Apple LaserWriter IIf. Dimensions (HWD): 8.6 x 20 x 18.5 inches. Weight: 45 pounds. Emulations: Adobe PostScript Level 2, HP PCL 4.*

Apple Personal LaserWriter NTR *List price: $2,199; bottom paper cassette (envelope or 250-sheet letter- or legal-size), $199; letter- or legal-size paper cassette, $79 each; envelope cassette, $89; toner cartridge, $99. Dimensions (HWD): 8 x 15 x 18.3 inches. Weight: 29.5 pounds. Emulations: Adobe PostScript Level 2, HP PCL 4.*

Circle 492 on reader service card

Brother International Corp. USA

Brother HL-4Ve
Brother HL-10V

BY HENRY FERSKO-WEISS

The $1,995 Brother HL-10V is Brother International Corp.'s flagship desktop laser, replacing the Brother HL-8V (reviewed in last year's annual printer issue). With its HP PCL 5 compatibility, solid performance, and $1,295 street price, the HL-10V is an admirable printer. The $1,595 4-page-per-minute Brother HL-4Ve (at a street price of

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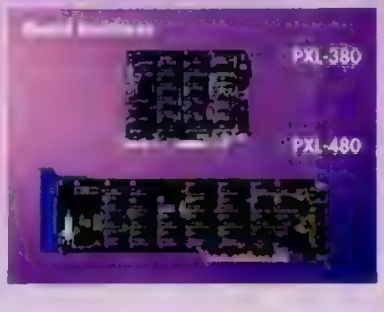

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CIRCLE 200 ON READER SERVICE CARD

$1,150) is similarly capable. But its options are costly: Adding the PostScript board doubles the price. The slim price margin between the two leaves the HL-10V as the clear favorite.

These two have much in common. Both have a 16-MHz Motorola MC68000 processor, emulate PCL 5, and offer High Resolution Control (which effectively smoothes text and line art to enhance their 300-dot-per-inch output). Both offer 64 gradations of gray, and produced solid gray scales.

Additional emulations include IBM Proprinter, Epson FX, and Diablo 630; the printers can automatically switch among these and PCL 5. Both include 12 portrait and 12 landscape bitmap fonts, while the HL-4Ve has 13 scalable fonts versus the HL-10V's 12. You get the standard HP LaserJet III typefaces plus Brussels. Each printer has 1MB of RAM and supports up to 5MB.

Brother HL-4Ve, Brother HL-10V

BROTHER HL-10V

The HL-10V offers several improvements over the HL-8V. The HL-10V features Brother's own 10-ppm engine, has a footprint that is approximately 33 percent smaller than the HL-8V's, and weighs 16 percent less. It's also $500 cheaper.

The HL-10V comes with a tray that holds 250 sheets of letter-, legal-, A4-, or B5-size paper or 15 envelopes. One slight flaw is that the accompanying manual doesn't explain how to load envelopes, which isn't obvious.

An additional $419, 250-sheet paper drawer clips on easily under the first drawer. If the top drawer runs out, the HL-10V automatically switches to the lower drawer. A paper jam occurred only once during our testing, and that was when the unit was printing a long run of envelopes.

A new tilting front control panel is easy to read under almost any light condition, and you can set the brightness of the 16-character LCD directly from the panel itself. The control panel allows you to set almost any printer feature, including fonts, emulations, High Res mode, interface (parallel or serial), and paper orientation.

In PCL 5 mode, the HL-10V scored 9.0 ppm on the Text Speed test, coming in fifth overall, although last among the closely ranked group of 10-ppm printers. On the Graphics Speed test, however, the unit scored 2.9 graphics pages per minute, besting other 10-ppm devices.

A $399 BR-Script PostScript cartridge should be available from Brother by the time you read this. The printer also accepts any standard LaserJet font cartridge.

The 10-ppm speed in an 11.5- by 16- by 14.6-inch box is quite attractive, as are the good output and solid overall performance. The moderate price makes this an even more appealing option.

BROTHER HL-4Ve

Targeted at the home-professional market, the HL-4Ve uses the same Canon LX engine that you'll find in the HP LaserJet IIP Plus. At $1,595, the HL-4Ve also costs $300 more than the base HP IIP Plus, though this is around what it would cost to upgrade HP's machine to PCL 5. If you're planning to upgrade to include PostScript, however, the HL-4Ve is not your best choice.

The HL-4Ve gains PostScript compatibility through an optional BR-Script board (which wasn't available for testing) that costs as much again as the original printer—hardly an ideal solution when you will be able to purchase the HL-10V with the BR-Script cartridge for considerably less. An alternative for those who want a 4-ppm unit with PostScript is the HL-4PS (which we reviewed last year), which Brother sells at a retail price of $2,595.

The HL-4Ve also uses a multipurpose paper feeder (70-sheet capacity), which pulls down from the side. For big print jobs, you can purchase an optional $195 lower cassette drawer that holds 250 letter-size sheets.

Alternatively, you can fit a 250-sheet tray for legal- or executive-size paper ($79 each) or for 75 envelopes ($99) into the lower drawer housing.

The HL-4Ve uses font cards rather than HP-compatible cartridges. Four are available, for $195 each. The unit includes a fax interface for the Brother M2100 and M2200 fax machines.

In PCL 5 text mode, the HL-4Ve handled 4.0 ppm on our Graphics Speed test; it tied with the HP IIP Plus as the fastest of the 4-ppm units, scoring 1.8 gppm. The HL-4Ve's image quality was quite good.

The HL-4Ve is a solid competitor, but its price is a handicap. The margin of difference to the HL-10V is only $400 retail; on the street, the spread is less than $150. And if you want PostScript, the HL-10V is both quicker and less expensive.

Brother International Corp. USA, *200 Cottontail Ln., Somerset, NJ 08875; 800-284-4357, 908-356-8880; fax, 908-469-5167.*

Brother HL-4Ve *List price: $1,595; 1MB RAM upgrade, $495; 2MB RAM upgrade, $990; 4MB RAM upgrade, $1,980; BR-Script PostScript emulation, $1,595; additional font cartridges, $195 each; lower cassette drawer (250 letter-size sheets), $195; 250-sheet legal- or executive-size paper cassette, $79 each; envelope cassette, $99; toner cartridge, $119. Dimensions (HWD): 8.6 x 25.4 x 13.6 inches. Weight: 26.5 pounds. Emulations: Brother Twinriter DP, Brother Twinriter WP, Diablo 630, Epson FX, HP PCL 5, IBM Proprinter XL.*

Brother HL-10V *List price: $1,995; 0K memory board, $149; 2MB RAM upgrade, $319; 4MB RAM upgrade, $699; BR-Script PostScript emulation, $399; 250-sheet multipurpose second paper cassette (letter-, A4-, legal-, executive-size), $419; toner cartridge, $130; AppleTalk interface, $269. Dimensions (HWD): 11.5 x 16 x 14.6 inches. Weight: 37.4 pounds. Emulations: Brother Twinriter DP, Brother Twinriter WP, Diablo 630, Epson FX, HP PCL 5, IBM Proprinter XL.*

Circle 493 on reader service card

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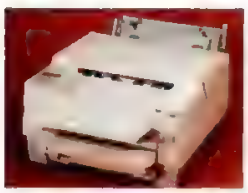

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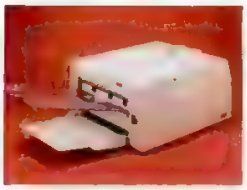

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CIRCLE 237 ON READER SERVICE CARD

C-Tech Electronics Inc.

C. Itoh ProWriter Desktop Laser Printer CI-8

C. Itoh ProWriter Desktop Laser Printer CI-8E

Mannesmann Tally Corp.

Mannesmann Tally MT908

BY SUSAN G. THOMAS

For respectable performance at mostly average prices, consider the new 8-page-per-minute models from C-Tech Electronics or Mannesmann Tally. C-Tech Electronics, a 1990 joint venture of C. Itoh and Tokyo Electric Co. (TEC), has two new lasers: the $2,395 C. Itoh ProWriter Desktop Laser Printer CI-8 and the $1,695 C. Itoh ProWriter Desktop Laser Printer CI-8E. Mannesmann Tally's $1,995 MT908, which the company acquires from TEC, is identical to the CI-8 in every aspect, starting with the 8-ppm TEC 1323D engine. The CI-8E includes an 8-ppm TEC 1323CE engine.

All three come standard with HP PCL 5. Destiny PDL PostScript emulation boards or a cassette (the latter for the CI-8E) cost $495 from C-Tech or $599 from Mannesmann Tally.

Price is the most obvious difference among these three. On the street, you can find the CI-8 for around $1,700, the MT908 for $1,400, and the CI-8E for $1,200.

Aside from their price tags, the three models seem indistinguishable. They are the same size, feature the same control panel, and are based on the same engine; they each come with 1MB of RAM, upgradable to 5MB with proprietary SIMMs. Prices range from $160 (MT908) to $185 (CI-8) for 1MB; 2MB costs from $310 (CI-8E) to $335 (CI-8).

Inside the case, the only real difference among the three units is on the controllers. The CI-8 and the MT908 both come with a 32-bit, 16-MHz Intel 80960 RISC processor; the CI-8E has a Motorola 68000 chip.

The CI-8 and the MT908 generally held their own against the other 8-ppm lasers. The CI-8E stayed close to both the RISC-aided printers during much of testing and actually outperformed them on the PCL Graphics Speed test.

All three printers had decent PCL 5 Text Speed scores (MT908, 7.7 ppm; CI-8E, 7.5 ppm; and CI-8, 7.4 ppm). On the PCL-mode Graphics Speed test, the CI-8E beat the other two with a score of 3 graphics pages per minute (compared with 2.8 gppm for the MT908 and 2.7 gppm for the CI-8). The CI-8E's graphics score tied with the Toshiba (which uses a TEC LB-1323 engine) for third place out of the entire desktop laser field.

In PostScript mode, the RISC-based duo was solid among the overall field and decidedly stronger than the CI-8E. The MT908 produced 7.6 ppm and 0.7 gppm and the CI-8 delivered 7.4 ppm and 0.7 gppm. The CI-8E scored only 6.4 ppm and a struggling 0.3 gppm, the slowest scores in this group. On our CorelDRAW PostScript tests using an HP LaserJet III driver, the CI-8E provided sluglike performance, taking more than 3 minutes for each test.

All three printers produced crisp, clean text output, with no discernible traces of jaggies or banding. All offer Edge Enhancement Technology to smooth their 300-dot-per-inch text and line art, but none provide enhancements for halftones.

C.Itoh ProWriter Desktop Laser Printer CI-8 and CI-8E, Mannesmann Tally MT908

The printers all have an easy-to-use control panel, with a 16-character LCD, that lets you set emulation switching, foreign-language instructions, and one user-definable setting. A 250-sheet tray that fits any paper size up to legal comes standard (and extends the footprint to 25.7 inches deep).

The units include the standard 8 scalable and 14 bitmap resident fonts of the LaserJet III. All feature two slots that accept HP-compatible font cartridges, though C-Tech does not sell any as options. Mannesmann Tally does, however, offer 12 cartridges at $265 each.

Network options are scarce: You can get an AppleTalk interface board for the CI-8 ($173) or the MT908 ($275).

The CI-8E is the least expensive of these three, and one to consider if PostScript is not your main concern. The other two are better options for PostScript users, though there are faster PostScript offerings at comparable prices also reviewed here.

C-Tech Electronics Inc., *2515 McCabe Way, Irvine, CA 92713; 800-347-4017, 714-833-1165; fax, 714-757-4533.*

C. Itoh ProWriter Desktop Laser Printer CI-8 *List price: $2,395; 1MB RAM upgrade, $185; 2MB RAM upgrade, $335; Destiny PDL PostScript emulation, $495; 300-sheet bottom paper cassette (letter-, A4-, legal-size), $175 each; 20-sheet output tray, $30; drum, $120; developer, $147.72; toner cartridges (two-pack), $59; AppleTalk interface board, $173; Mac Pat Kit, $850. Dimensions (HWD): 8.6 x 15.5 x 25.7 inches. Weight: 31 pounds. Emulations: Epson FX, Epson MX, HP PCL 5, IBM Proprinter.*

C. Itoh ProWriter Desktop Laser Printer CI-8E *List price: $1,695; 1MB RAM upgrade, $165; 2MB RAM upgrade, $310; Destiny PDL PostScript emulation, $495; 300-sheet bottom paper cassette (letter-, A4-, legal-size), $175 each; 30-sheet output tray, $30; drum, $120; developer, $147.72; toner cartridges (two-pack), $59. Dimensions (HWD): 8.6 x 15.5 x 25.7 inches. Weight: 31 pounds. Emulations: Epson FX, Epson MX, HP PCL 5, IBM Proprinter. Circle 494 on reader service card*

Mannesmann Tally Corp., *P.O. Box 97018, Kent, WA 98064-9718; 800-843-1347; fax, 206-251-5520.*

Mannesmann Tally MT908 *List price: $1,995; 1MB RAM upgrade, $160; 2MB RAM upgrade, $320; Destiny PDL PostScript emulation, $599; additional font cartridges, $265 each; second multipurpose 300-sheet paper cassette (letter-, A4, legal-size), $180; drum, $140; developer,*

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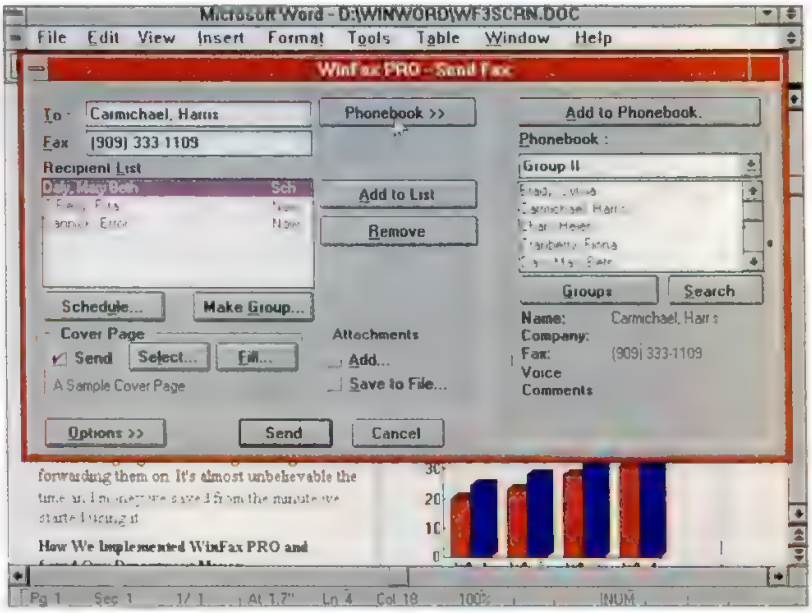

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CIRCLE 250 ON READER SERVICE CARD

$185; toner cartridges (two-pack), $45; AppleTalk interface, $275. Dimensions (HWD): 8.6 x 15.5 x 25.7 inches. Weight: 31 pounds. Emulations: Epson FX, Epson MX, HP PCL 5, IBM Proprinter. Circle 495 on reader service card

Epson America Inc.

Epson ActionLaser II
Epson EPL-8000

BY EDWARD MENDELSON

The newest 300-dpi laser printers from Epson America offer the same kind of workhorse efficiency and economical prices that have made Epson's dot matrix models an industry standard. The $1,999 10-page-per-minute Epson EPL-8000 emulates the LaserJet III but prints with darker blacks. The bargain-basement-priced $999 6-ppm Epson ActionLaser II emulates the LaserJet IIP. Both provide industry-standard features at low prices.

Epson EPL-8000, Epson ActionLaser II

The two offer some of the same features, starting with a standard parallel and serial port. To each printer, you can add an extra parallel or serial port (with a 32K buffer, $152 apiece), or a $699 card for mainframe connections. That's three users when you add one of the regular ports, or four with the mainframe connection—although the ActionLaser is too slow to make it practical to add extra users.

You can assign different emulations to each port, and both printers switch ports automatically. The EPL 8000 can switch between its LaserJet mode and its built-in Epson dot matrix emulation or its $649 optional Adobe PostScript mode. The ActionLaser II offers HP PCL 4 and Epson dot matrix modes; HPGL is a $299 option, and Adobe PostScript costs $649.

ACTIONLASER II

If you don't already have a laser printer, this model's $700 street price may tempt you. The ActionLaser II uses a Ricoh LP-1200 engine that gives clear, sharp output, even without resolution enhancement or other high-end features. You can upgrade the 512K of RAM to 5.5MB using standard DRAM.

The paper tray holds 100 letter-size sheets (30 more than the HP LaserJet IIP Plus). A $210 multipurpose paper tray holds 150 letter- or legal-size sheets. The printer has a slot for one LaserJet-compatible font cartridge (for PCL 4 bitmap fonts only) and one slot for the Epson HPGL or Adobe PostScript emulation.

On PC Magazine Labs' tests, the ActionLaser performed respectably for a 6-ppm printer. In PCL 4 mode, it scored 6 ppm on our Text Speed test and 1.5 graphics pages per minute on our Graphics Speed test. In PostScript mode, the unit produced 5.5 ppm and 0.4 gppm.

The ActionLaser II is a solid low-end printer at a good price: the lowest price of the group we tested, in fact. Its combination of features—especially its Adobe PostScript option—may make it worth considering if your budget is tight.

TOP OF THE LINE

The Epson EPL-8000 gives you almost everything you get from the LaserJet III, for a street price of about $1,350.

You get full PCL 5 compatibility and Epson's built-in RITech print enhancement, which works like HP's Resolution Enhancement Technology. The Minolta NC-10 engine provides sharp and vivid graphics. The printer also comes with clone versions of the LaserJet III's scalable CG Times and Univers fonts, plus scalable versions of Zapf Dingbats and a compressed version of Univers.

The standard letter-size paper tray holds 250 sheets, 50 more than the LaserJet III. A built-in feeder holds 10 to 15 envelopes. A $399 lower tray holds 250 legal- or letter-size sheets. You can upgrade to 7.5MB with standard DRAM. You get one slot for HP-compatible font cartridges and two slots for PCMCIA cards with emulations and additional fonts, though no PCMCIA font cards are currently available.

On our tests, the printer performed impressively in PCL 5 text mode: 9.9 ppm. Its 2.1 gppm in PCL graphics mode was respectable, though bested by some 8-ppm engines. PostScript performance was a little slow compared with other 9- and 10-ppm units: 7.4 ppm and 0.5 gppm.

Though it lacks a network connection, its dark, well-defined graphics and generally good performance make it a worthy choice for anyone looking for a low-priced, LaserJet III–compatible printer.

Epson America Inc., *20770 Madrona Ave., Torrance, CA 90503; 800-922-8911, 310-782-0770; fax 310-782-4235.*

Epson ActionLaser II *List price: $999; 0K RAM expansion board , $65; Adobe PostScript, $649; HPGL emulation, $299; 150-sheet multipurpose paper cassette (envelope-, letter-, A4-, legal-size), $210; 100-sheet legal paper cassette, $79; drum, $175; toner cartridge, $125; serial adapter, $88; serial or parallel adapter with 32KB, $152 each; mainframe interface, $699. Dimensions (HWD): 6.9 x 12.8 x 15.1 inches. Weight: 27 pounds. Emulations: Epson FX, Epson LQ, Epson MX, HP PCL 4.*

Epson EPL-8000 *List price: $1,999; 0K RAM expansion board, $65; Adobe PostScript, $649; 250-sheet multipurpose bottom paper cassette (letter-, A4-, legal-size), $399; 250-sheet legal-size paper cassette, $79; 50-sheet faceup output tray, $35; toner cartridge, $239; serial adapter, $88; serial or parallel adapter with 32KB, $152 each; mainframe interface, $699. Dimensions (HWD): 10.5 x 18.8 x 15.1 inches. Weight: 40 pounds. Emulations: Epson FX, Epson LQ, Epson MX, HP PCL 5. Circle 496 on reader service card*

Fujitsu Computer Products of America Inc.

Fujitsu Print Partner 10

BY ROBERT S. ANTHONY

If you want to be able to connect some cables and get right to work with your new laser printer, you're going to like the Fujitsu Print Partner 10. At $1,995, the 10-page-per-minute Print Partner 10 il-

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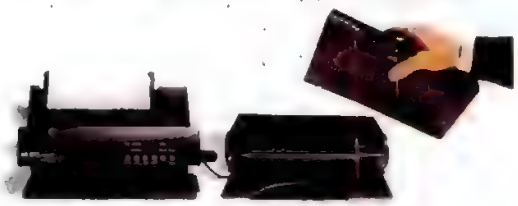

The HP DeskJet Portable.

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Hewlett-Packard presents the DeskJet for the jet set. The new HP DeskJet Portable printer lets you create great-looking documents anywhere you go.

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The DeskJet Portable is built tough to take more than the usual amount of jostling. And, to make it even more versatile, an optional rechargeable battery is available, along with a World-wide Rapid Recharger, a 50-page cut-sheet feeder and a handy carrying case.

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†In Canada call 1-800-387-3867, Ext. 7108.

lustrates that solid engineering need not be expensive or tough on the user.

With its Minolta SP10 engine, 15-MHz AMD 29005 RISC chip, built-in HP PCL 5 capability, and versatile control panel, the 300-dot-per-inch Print Partner 10 was a solid performer on our tests.

In PCL mode, the Print Partner 10 led the field on our Text Speed test, with 10.1 ppm. It also delivered a blazing 3.1 graphics pages per minute on the PCL Graphics Speed test, second only to the Samsung Finalé 8000. In PostScript mode, the unit's scores were 8.3 ppm and 0.8 gppm. In both modes, the HP LaserJet III driver produced solid performance under Windows.

The unit also includes IBM Proprinter and Epson FX emulations. With the painless installation of a $499 Microsoft TrueImage 1.1.1 option board, you get access to 35 PostScript-compatible fonts as well as use of the otherwise dormant AppleTalk connection. The unit also has two slots for HP-compatible font cartridges. The printer switches emulations through software.

Output for this system is just fine, helped along by Fujitsu's ART (Advanced Resolution Technology), similar to HP's RET.

The unit's 16-character control panel provided easy and quick access to the standard PCL 5 fonts, paper-handling, and image functions. You can select page orientation, preview, jam recovery, wait time, and more.

Fujitsu Print Partner 10

The base configuration includes a 250-sheet letter-size paper tray, a 150-sheet output tray, and 1MB of RAM, expandable to 9MB with standard SIMMs. For $299, you can get a second paper drawer with a 250-sheet, letter-size paper tray. Adding this gives you a taller but very useful machine, able to take on heavy usage without straining itself.

For ease of use and solid performance, the Fujitsu Print Partner 10 is a definite contender in the mainstream laser arena.

Fujitsu Computer Products of America Inc., *2904 Orchard Pkwy., San Jose, CA, 95134-2009; 800-626-4686, 408-432-6333; fax, 408-894-1706.*

EDITORS'CHOICE ▶ **Fujitsu Print Partner 10** *List price: $1,995; 1MB RAM upgrade, $159; 4MB RAM upgrade $499; Microsoft TrueImage PostScript emulation, $499; second cassette tray assembly (250-sheet letter-size paper cassette), $299; 250-sheet multipurpose cassette (letter-, legal-, A4-, executive-size) for second cassette unit, $125; 250-sheet paper cassette (letter-, legal-, A-4, executive-size), $79 each; 50-sheet output tray, $20; toner cartridge, $230. Dimensions (HWD): 9.8 x 18.5 x 15.8 inches. Weight: 37.5 pounds. Emulations: HP PCL 5.*
Circle 497 on reader service card

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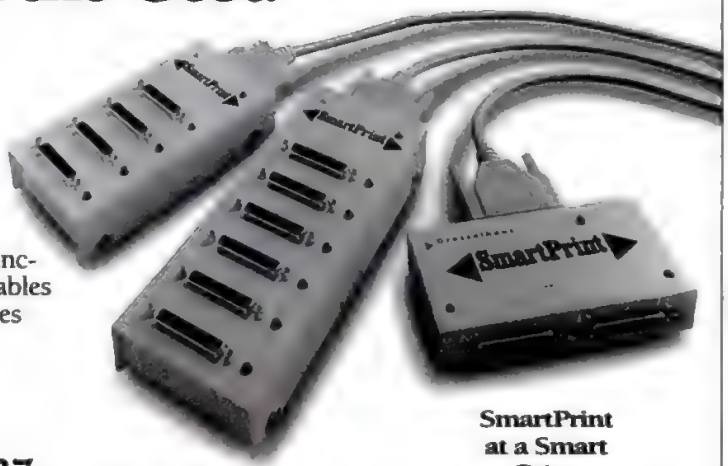

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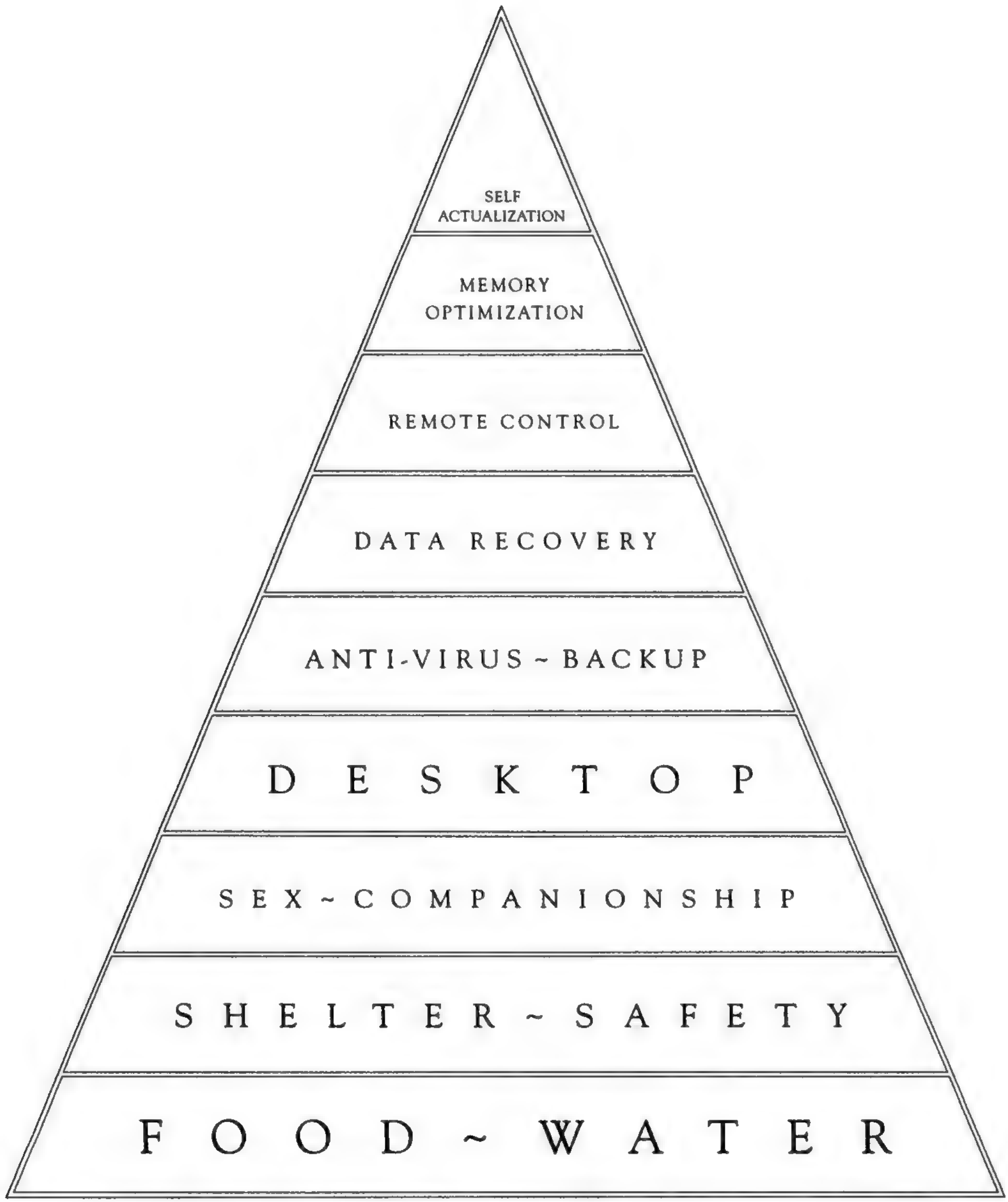
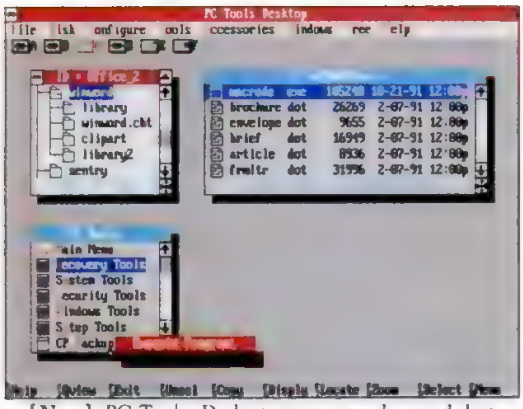


fig. [1]
Maslow's Hierarchy of Needs.



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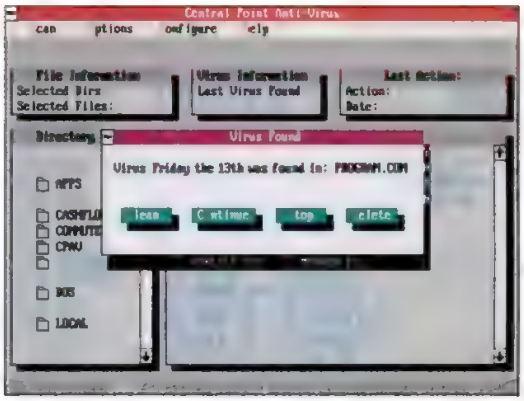

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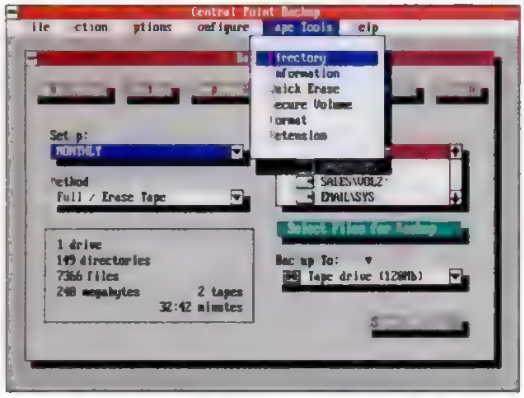

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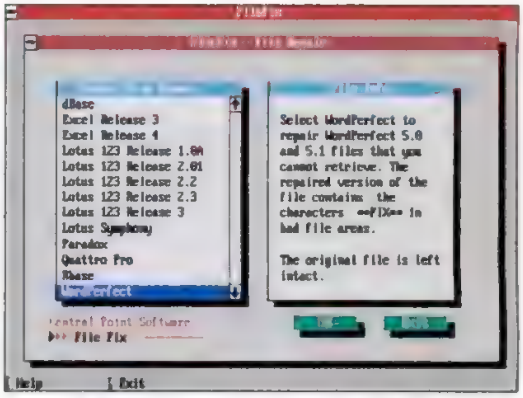

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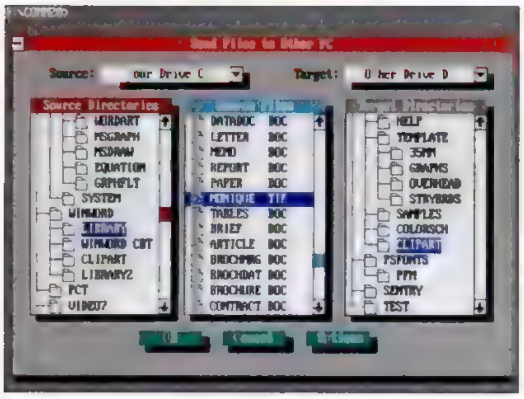

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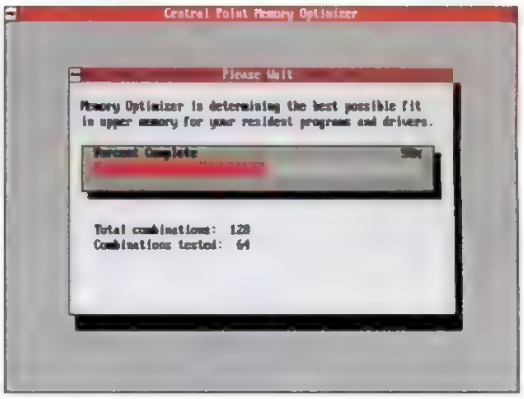

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CIRCLE 081 ON READER SERVICE CARD

Hewlett-Packard Co.,
Direct Marketing Organization

HP LaserJet 4
HP LaserJet 4M
HP LaserJet IIP Plus

BY EDWARD MENDELSON

To no one's surprise, the new generation of Hewlett-Packard Co.'s 8-page-per-minute laser printers transforms the market, just as each earlier generation did.

The HP LaserJet 4 ($2,199), priced below the discontinued HP LaserJet III, offers 600-dpi printing in HP PCL mode, complete with built-in TrueType support and better graphics and text quality than other printers with the same resolution. The HP LaserJet 4M ($2,999) adds Adobe Level 2 PostScript and support for AppleTalk networks. On the street, both should sell for about 70 percent of their list prices.

Meanwhile, at the bottom of HP's line, the 300-dpi HP LaserJet IIP Plus ($1,249) offers full HP compatibility at a reasonable price: around $850 on the street.

HP LaserJet 4M, HP LaserJet IIP Plus, HP LaserJet 4

LASERJET 4 SERIES

The LaserJet 4 series brings moderately priced desktop printing to new levels of flexibility and quality. The basic $2,199 LaserJet 4 uses HP's Resolution Enhancement Technology (RET), microfine toner, and the new Canon P-270 engine to produce pages with higher apparent resolution than all rival 600-dpi models. Text has a crispness and clarity you won't find elsewhere on a desktop, except from printers such as LaserMaster Corp.'s 1,000-dpi models. Its graphic output comes within shouting distance of photographic quality.

The $2,999 LaserJet 4M adds 4MB of RAM to the LaserJet 4's base 2MB, includes PostScript support, and installs an HP JetDirect AppleTalk network interface card in the modular I/O slot. You can upgrade the LaserJet 4 to PostScript status with a $499 optional SIMM. If you don't add the PostScript option, you can install up to 34MB of RAM in the LaserJet 4; with PostScript, you can install up to 26MB, the same limit as that of the LaserJet 4M.

The LaserJet 4 and LaserJet 4M accept optional HP JetDirect Ethernet ($695) and Token-Ring ($895) cards, though you'll have to take the AppleTalk card out of the LaserJet 4M.

Both units can switch automatically between PCL and PostScript modes, and all ports can be active at the same time. You get printer drivers for Windows and major DOS applications in the box with both models; Adobe's Level 2 PostScript driver comes with the LaserJet 4M.

The speed of both models is the product of a 20-MHz Intel 80960 RISC processor and a new parallel port that accepts data at a 156-kilobyte-per-second continuous transfer rate, ten times as fast as the LaserJet III. Unlike earlier models, the printers start processing data soon after they're switched on—and before the engine is ready to print.

In PCL testing, the LaserJet 4 and LaserJet 4M produced 300-dpi text at just under their 8-ppm rating—7.9 ppm. They handled graphics at 2.4 graphics pages per minute and 3.5 gppm, respectively. In PostScript mode at 300 dpi, the LaserJet 4M output text at 7.9 ppm and graphics at 0.8 gppm. As with other printers capable of 600-dpi resolution, switching to 600-dpi graphics cut graphics speed by more than half on our informal tests.

HP's new parallel port permits bidirectional communications like a serial port but at a much greater speed. The standard parallel port in your PC can receive data from the printer through a device driver supplied in the box. Future versions of standard applications will probably provide two-way access to the printer via the new port.

The enhanced PCL 5 printer control language still uses Intellifont as one of its native font formats, but it adds TrueType as a second format. The printers come with 35 Intellifonts plus 10 TrueType fonts that match the proportional and symbol fonts built into Windows. This should help some Windows application files print at a higher speed, although the printers' performance on our Word for Windows test was only good rather than exceptional. The printers will also allow new versions of DOS applications to use TrueType.

Two paper trays are built into each unit: a standard letter tray with 250 sheets and a multipurpose tray that holds 100 sheets of letter-, legal-, executive-, or A4-size paper. A 500-sheet tray fits below the printer, and a power envelope feeder holds 75 envelopes. (Prices for these had not been set at press time.) A single cartridge slot lets you plug in a standard LaserJet font cartridge.

HP has dropped the video port that allowed third-party add-in boards in your computer to control earlier LaserJets, but the new high-speed parallel port allows comparably fast access to the printer without costly additional hardware. The modular input slot now used for network cards will probably serve as an interface for other HP and third-party add-in boards in the future.

All these features come in a smaller footprint than earlier 8-ppm LaserJets: 16.3 by 15.8 inches. Also, the bright 20-character fluorescent LCD outshines the dim LED displays on other lasers. As a bonus, the display gives you the clearest menu structure of any current model.

The one disappointment in the new LaserJets is the lack of any provision to add an internal hard disk for storing soft fonts. Third-party vendors may be able to fit a hard disk on a board that plugs into the modular I/O slot, but HP has made no provision for a disk and has no plans to offer one.

In their price class, these new LaserJets rank as two of the finest printers ever made. They have sufficient speed for anything less than a high-volume environ-

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CIRCLE 028 ON READER SERVICE CARD

ment, they offer superb print quality, and they're the only printers on the market that are thoroughly HP and Adobe compatible. You'll have to work hard to find reasons to choose anything else.

LASERJET IIP PLUS

HP's $1,249 LaserJet IIP Plus is based on a 4-ppm Canon LX engine. Designed for personal or small-office use, this low-end printer dispenses with fancy features, but it remains ideal for its intended use.

You get only bitmapped Courier and LinePrinter fonts in the printer, but you can plug a $299 PCL 5 cartridge in the single cartridge slot to add scalable CG Times and Univers fonts and support for scalable Intellifont soft fonts. You can also install HP's $495 Adobe PostScript cartridge for Level 1 PostScript support. (We didn't receive the PCL 5 or PostScript options for testing.)

To use the PCL 5 cartridge, you'll need to add at least 1MB of RAM to the 512K that comes with the printer. The unit supports up to 4.5MB of RAM; 1MB costs $230, and 2MB costs $390.

The unit gains speed from its 16-MHz 68000 processor. On our PCL tests, the IIP Plus printed text at engine speed and graphics at 1.8 gppm (tying with the Brother HL-4Ve for the strongest graphics score of the 4-ppm printers in this roundup).

The printer's parallel port accepts data at about 50 KBps, almost five times as fast as the LaserJet III or the original and now discontinued IIP. Because the printer is meant only for the PC market, you can't add a serial port, but you probably won't want one.

The built-in multipurpose tray holds 70 sheets. A $195 lower cassette holds 250 letter-size sheets and transforms the basic model into a dual-bin printer that lets you keep letterhead or five envelopes in the multipurpose tray and ordinary paper in the add-on cassette.

For a small budget and a small desktop, the HP LaserJet IIP Plus probably offers everything you need.

Hewlett-Packard Co., Direct Marketing Organization, *P.O. Box 58059, Santa Clara, CA 95051; 800-752-0900, 208-323-2551; fax, 208-344-4809.*

EDITORS'CHOICE ▶ HP LaserJet 4 *List price: $2,199; 1MB RAM upgrade, $109; 2MB RAM upgrade, $199; 4MB RAM upgrade, $299; 8MB RAM upgrade, $569; Adobe PostScript Level 2 SIMM, IBM Proprinter, or Epson emulation, $499 each; additional font cartridges, $195 to $349; HP typeface disks, $99 to $249; toner cartridge, $150; Ethernet interface, $695; Token-Ring interface, $895; TCP/IP interface, $895; parallel cable, $27. Dimensions (HWD): 11.7 x 16.3 x 15.8 inches. Weight: 35 pounds. Emulations: Enhanced HP PCL 5.*

EDITORS'CHOICE ▶ HP LaserJet 4M *List price: $2,999; no Adobe PostScript Level 2 SIMM; other options the same as for the HP LaserJet 4. Dimensions (HWD): 11.7 x 16.3 x 15.8 inches. Weight: 35 pounds. Emulations: Adobe PostScript Level 2, enhanced HP PCL 5.*

HP LaserJet IIP Plus *List price: $1,249; 1MB RAM upgrade, $230; 2MB RAM upgrade, $390; PCL 5 emulation, $299; Adobe PostScript, $495; additional font cartridges, $195 to $349; 250-sheet lower paper cassette (letter-size), $195; 250-sheet bottom paper cassette (legal-, executive-, or A4-size), $274, $270, and $264, respectively; envelope cassette, $284; HP typeface disks, $99 to $249; toner cartridge, $95. Dimensions (HWD): 8 x 13.8 x 16 inches. Weight: 22 pounds. Emulations: HP PCL 4.*

Circle 485 on reader service card

For a small budget and a small desktop, the HP LaserJet IIP Plus probably offers everything you need.

Kyocera Electronics Inc.

Kyocera Ecosys a-Si Printer FS-1500A

BY EDWARD MENDELSON

If you're concerned about the environment—or about consumable costs—the Kyocera Ecosys a-Si Printer FS-1500A ($2,395), from Kyocera Electronics, may offer some relief. This 10-page-per-minute, 300-dot-per-inch model (compatible

with the HP LaserJet III) has an unusual design: Its drum and photoconductor last the life of the printer. Instead of throwing away a cartridge when you run out of toner, you just replace the toner powder.

The *a-Si* in the printer's name stands for *amorphous silicon,* the long-lasting material in the drum. Because you never discard the drum, you can run the printer at a startlingly low operating cost: around 0.8 cents per page, compared with around 3 cents for many competing models.

The name *Ecosys* implies ecological awareness, and Kyocera emphasizes that the plastic box containing the toner can be burned without releasing toxic gases. Kyocera also claims that the printer releases extraordinarily small amounts of ozone.

The Ecosys is also remarkable for its light weight (30 pounds) and compact footprint (less than 14 inches square). A 250-sheet built-in multipurpose paper tray can be stacked on top of one or two $499 lower trays that hold 500 sheets each, a $699 module that allows automatic duplex printing, and a $1,995 15-bin sorter. None of these were ready for testing, but they should be available by the time you read this.

HIGH-QUALITY OUTPUT

The Ecosys uses a Kyocera LED array a-Si engine and KIR (Kyocera Image Refinement), the company's proprietary resolution enhancement technology, all driven by a 16-MHz Motorola 68000 processor. The result is output that rivals the clarity of the LaserJet III—at a greater speed than the LaserJet III's 8-ppm engine can provide. On tests in HP PCL 5 mode, the Ecosys printed text at 9.3 ppm and graphics at 2.2 gppm.

The Ecosys goes beyond the LaserJet III by providing 79 bitmapped fonts and 13 scalable fonts, including versions of Univers Compressed and ITC Zapf

FROM Esc A TO Z

This *PC Magazine* foldout contains a summary of tips, compiled by our contributing editors, for efficiently running your HP LaserJet–series or compatible printer. You'll find information on everything from faster Windows printing and other software tips to easing headaches from printing envelopes and fixing a few common error messages. Also included is information on little-known ways to customize your LaserJet, some useful escape sequences, and even a new utility. Users of HP LaserJet–series printers should keep in mind that one of the things that makes them so great is the excellent manuals. The staff of *PC Magazine* has seen documentation for a huge range of peripherals, systems, and software, and very few can compare with HP's surprisingly well-done printer documentation. Taking the time to read it carefully may be one of the best tips we can offer to HP users.

Windows Printing

◆ Sending Print Directly to the Hardware Port You can send a file to the printer at top speed by printing directly to the hardware port instead of going through the BIOS. In Windows, select Printers from the Control Panel; then choose the Connect option and check Fast Printing Direct to Port. (In WordPerfect, you can accomplish the same thing by using the Print, Select, Edit menu and selecting yes for the print-to-hardware-port option.) If you select these options, you may find that you won't be able to type quickly after sending a print job, but print data will reach the printer faster. (Naturally, these and the following Windows printing tips will work with just about any printer, not just a LaserJet or compatible.)

◆ Turning Off the Print Manager You can also speed up printing in Windows by turning off the Windows Print Manager.

Go to the Control Panel, choose Printers, and make sure there is no check mark in the Use Print Manager check box. If there is one, toggle it off. With the Print Manager off, data will go directly to your printer.

At the very least, turning the Print Manager off will save the time it takes to spool the data to disk first. It may save more time still. When the Print Manager is on, even after it starts sending data to the printer, it may not be sending the data as quickly as your printer can accept it. This is particularly true if you have the Print Manager set to Low Priority, so that Windows gives more attention to other tasks (such as accepting input from the keyboard). The bottom line: Turning the Print Manager off will speed printing. How much depends on your printer, how large the file, how much RAM the printer has available for buffering data, and other variables.

◆ Speeding Return of Control If your goal is getting back control of your PC as quickly as possible (even if it means slowing down the speed of output), you'll want the Print Manager on.

Choose Printers from the Control Panel, as described in the previous tip, and make sure the Use Print Manager check box is selected. Next, exit the Control Panel and open the Print Manager. From the Options menu, select Low Priority.

This setting will ensure that Windows spends less time on printing once the file is spooled to disk, and more time with other tasks, such as accepting input from the keyboard.

You can see the effect of the Low Priority setting by printing at that level while trying to work in a program.

◆ Fast Printing and Fast Return Of Control If you want fast printing *and* quick return of keyboard control, you'll need at least 2MB of RAM for a RAM disk.

Set up the RAM disk, set the Print Manager at Low Priority, and then set the TEMP directory in your AUTOEXEC.BAT file to point to your RAM disk.

For example, to use RAMDRIVE.SYS to create a 2MB RAM disk from extended memory, you need to add a line to your CONFIG.SYS file:

```
Device=d:\path\ramdrive.
 sys 2048 /e
```

Here, `d:\path` describes the drive and path where RAMDRIVE.SYS is located, `2048` specifies a 2MB size, and `/e` specifies using extended memory (this must be loaded after HIMEM.SYS or some other extended memory manager).

The SET TEMP line in your AUTOEXEC.BAT file should read:

```
SET TEMP=d:\
```

Here `d:` is the RAM disk.

With these settings, Windows will spool the print data to the RAM disk. Since RAM is far faster than any hard disk, this will speed up disk access, and therefore printing, while still giving you fast return of control. Be aware, however, that some programs tend to hang if they run out of disk space while printing. Even a 2MB RAM disk may not be enough for those programs when printing large files.

Printing with Envelopes

◆ Cutting Costs with Laser Labels Running a sheet of labels through most laser printers more than once risks having a label come off inside the printer, which could cause major headaches. But it's hard to justify using an entire sheet of labels to print just one. You can minimize the waste by cutting a full sheet into smaller pieces.

A sheet of 20 mailing labels, for example, typically includes a perforation parallel to the long edge of the page. Tear the sheet into two strips of 10 labels each, then cut those strips in half horizontally. This leaves only 5 labels per section. If you need to print only a single label, you'll be wasting just 4 labels rather than 19. When you feed the labels, you'll want to use the original top or bottom edge as the leading edge going into the printer. If you use the cut side, you again risk having a label peel off inside the printer.

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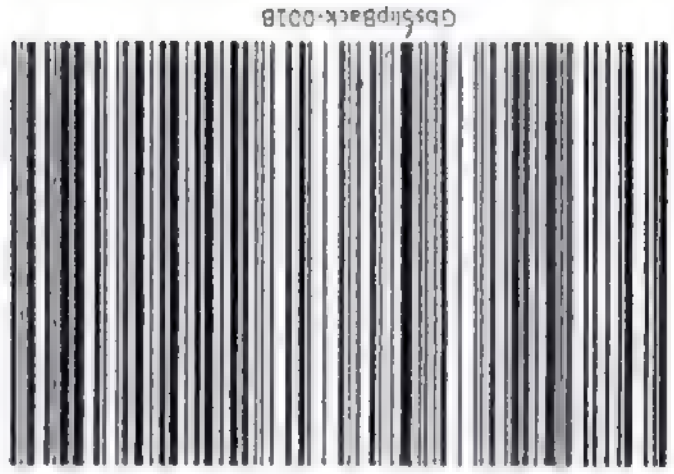
Inverted Back

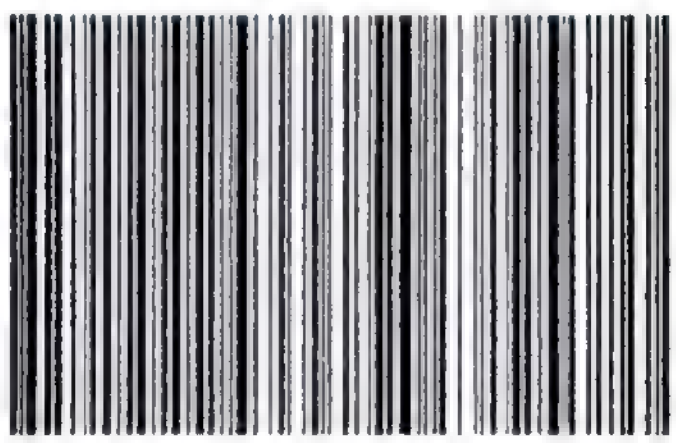
1. Follow instructions on the other side



Back

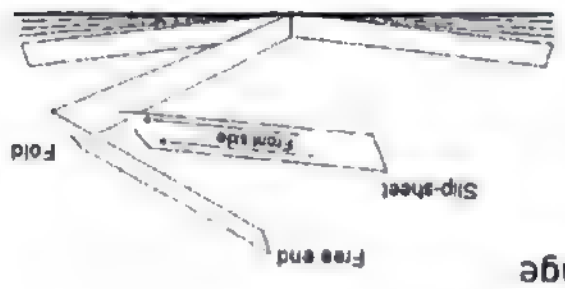
1. Follow instructions on the other side

Folded edge of the page



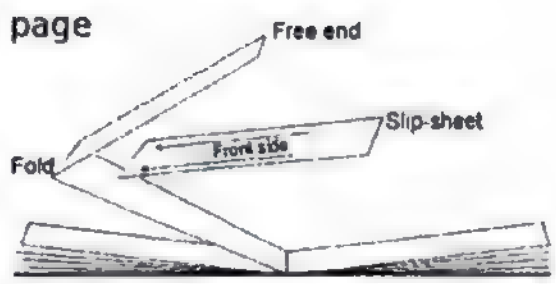
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Only one printer can give you this fax.

***Our goal at NEC is the complete integration** of computers and communications. The Silentwriter Model 95fx is just one of many innovative products that help us to realize this goal. For example, we not only developed the first notebook computer with a built-in phone and fax, we make satellite dishes capable of sending data worldwide.*

nce upon a time, all faxes looked the same. *Bad*. But with the Silentwriter® Model 95fx multifunction printer/fax, nothing gets lost in the transmission. Imagine PostScript™ language–quality *faxes* from your printer. It's no fairy tale. Now you can send and receive documents in all their original glory. You'll see beautiful fonts and graphics with none of the dirt and glitches, the jaggies and imperfections, that can turn a wonderful story into a tragedy. Why send a facsimile when you can send an original? Get the NEC Silentwriter Model 95fx multifunction printer/fax and live happily ever after.

The End

Actual facsimile generated from a Silentwriter Model 95fx.

C&C
Computers and Communications

To upgrade your existing Silentwriter Model 95 printer with fax capability (U.S. only), or for more information

FROM Esc A TO Z

◆ **Feeding Without Jams** If your favorite envelopes don't feed reliably, consider getting envelopes made specifically for laser printers. These are designed with sharp creases at the leading edge and minimum bulges at the seams.

Some sources for laser printer envelopes are Atlantic Envelope Co. in Nashville (minimum order, 2,500 for $36.88, plus shipping charges; 800-251-1396) and Magic Image Printing in Houston (minimum order, 100 for $4, plus shipping charges; 713-622-3265). Another source is PaperDirect in New Jersey (minimum order, 50 for $6.95 to $12.95, depending on envelope stock, plus shipping and handling; 800-272-7377, 201-507-5488).

If you don't want to pay the price of laser envelopes, test a range of envelope stocks in your printer. In general, you'll find that inexpensive envelopes with lightweight paper work better than those made with heavier stock. Some inexpensive envelopes, however, tend to wrinkle.

◆ **Improving Print Quality** The HP LaserJet Series II and many other printers based on the Canon SX, as well as some other engines, often have problems printing on the trailing edge of an envelope, where the return address goes in standard landscape mode. By the time the printer reaches that trailing edge, most of the envelope is already out of the printer's grasp, which can lead to slight movement and cause blurry printing. Bulges at the seams can also make the envelope shift slightly as it moves through the printer, another source of blurry printing.

You can improve the printer's ability to grasp the envelope, thereby improving the print quality, by stuffing the envelope with a sheet of 30-pound or heavier–weight paper. Cut the paper to fit snugly in the smaller dimension of the envelope, but leave about an inch of space in the long direction. To use the cut form, butt it up against the trailing edge of the envelope, so the envelope feeds first by the edge that is empty.

If you are familiar with Woody's Office Power Pack (WOPR), $49.95 from Pinecliffe International, you'll recognize this little trick as the Enveloper Cheat Sheet. As the Enveloper manual warns, the filled envelope is out of spec for the Canon SX engine, so if you're nervous about such things, don't use this trick. According to the manual, however, long-term users of the Cheat Sheet report no problems.

On a LaserJet III or compatible, you can help avoid smearing if you insert the envelope with the return address first, and print in the upside-down landscape mode available with PCL 5. The code for this mode, which Hewlett-Packard calls "reverse landscape," is:

```
Esc &l30
```

That's a lowercase *l* and the letter *O*.

You can insert this code manually in most word processors, using a function such as WordPerfect's Printer Command menu item. With WordPerfect, if you save the code to a file, you can insert the file from the same menu.

Software Tips

◆ **Fitting Your Spreadsheets** Spreadsheets have a tendency to wind up just a little too wide to fit on one A-size page (or fully across two pages or more), leaving an orphan column or two on another piece of paper. To solve this, you could automatically reformat the file to make the data fit completely on one A-size page, or stretch fully across two or more pages. (You might also consider using a PCL-compatible laser capable of printing on B-size paper; these usually cost upwards of $4,500, though—an expensive choice if you don't regularly require their capabilities.)

Reformatting in Microsoft Excel 4.0 is fairly easy. Choose File, then Page Setup, and use the choices in the Scaling box to fit the spreadsheet to some specific number of pages wide. (You can also independently set the number of pages tall.)

Lotus 1-2-3 users—at least those with the Windows version and those with DOS versions that include the WYSIWYG add-in—have a less flexible feature that will shrink the output to fit on a single page. With the WYSIWYG add-in, set the spreadsheet for automatic compression by choosing Print, Layout, Compression, Automatic. In the Windows version, choose File, Page, Settings, and then check the Fit to Page check box.

Note, however, that the automatic-compression and fit-to-page features will shrink the entire spreadsheet to one page, not just one dimension. If you have a long spreadsheet, it may become unreadable. There are workarounds to the problem, but they are as time-consuming as manually reformatting. If you're a 1-2-3 user who shares office space with an Excel user, the best choice may be to print the file in Excel. Simply open the 1-2-3 file with Excel, and follow the directions already given.

◆ **Portrait to Landscape Mode via a Windows Icon** FLIPPER.EXE is a free Windows utility from Barry Press that you can find on PC MagNet and other on-line services. It runs as an icon with an arrow that points either vertically or horizontally, depending on whether the current orientation of the printer driver is portrait or landscape. Simply double-click on the icon and it switches the orientation of spreadsheets, word processing documents, or any other document, without making you go to the Control Panel to choose the Setup option under Printers.

◆ **WordPerfect Underlining** Hewlett-Packard's PCL 5 underlining leaves the underline so close to the text that it intersects the descenders on letters such as *g, j, p, q,* and *y,* and leaves you with text that can be difficult to read.

WordPerfect 5.1 lets you adjust the underline distance through its printer-definition program, PTR.EXE. To accomplish this, first make a backup of your LaserJet .ALL file; its name will likely be WPHP1.ALL, WPHP51.ALL, or something similar. If you're using a printer other than a LaserJet, the name will probably be different, although it will still have an .ALL extension. You can always find your printer by running PTR, pressing F5 to see a list of files (specify the directory where you keep printer files at the prompt), and then selecting Look; the display will scan through all your .ALL files and list the printers included in each.

Open the .ALL file that contains the definition of your printer. Move the highlight to the name of the printer model and press Enter to select it. On the next menu, select Attribute Methods; on the next, Underline. The following menu shows an asterisk next to Auto Underline on Same Pass. Move the highlight to Auto Underline on Separate Pass, and type an asterisk to select it. Then hit Enter.

On the next menu, adjacent to Auto Underline On, type hpundon.

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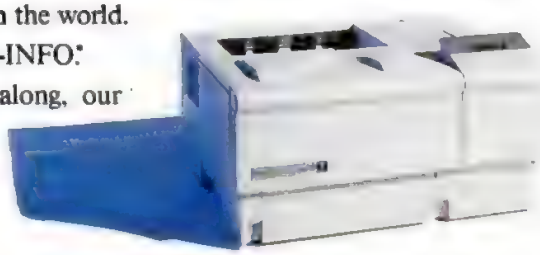

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CIRCLE 157 ON READER SERVICE CARD

FROM Esc A TO Z

◆ **Eject the Page Automatically After You PrtSc** A tiny utility called PRTSCF.COM, now available on PC MagNet, loads an 800-byte TSR (terminate and stay resident) program, which forces a form-feed after a print screen command. This works with all printer models except PostScript printers.

◆ **Let the Printer Make the Copies** LaserJet printers have a command that allows you to specify the number of copies to be printed for each page. If you are printing multiple copies of a document, it's much faster to use this feature than to have a program send the document repeatedly. The reason is that the printer only has to receive the data for a page once, and can then print at engine speed instead of waiting for the computer.

Many applications, however, explicitly set the number of copies as part of the printer driver setup string, which can override the number of copies set in the printer (even if they were set through a PCL command or with the front-panel controls). You can work around this by embedding the PCL command for the number of copies in your document, provided your program has a way to enter that command. To set the printer to print two copies of every page, for example, use this command:

```
<Esc> &l2X
```

The digit that follows the lowercase *l* is the number of copies.

◆ **New Default Font and Margins** If you want to print a text file in the built-in LaserJet III– or 4–series CG Times font, instead of the default Courier, create a file containing the following characters and copy it to the printer port:

```
Esc (s1p4101T
```

To use the built-in Univers font, use 4148 instead of 4101. To use the line printer font, use these characters:

```
Esc (s0p16.67h0T
```

To restore the Courier default font, use

```
Esc (s0p10h3T
```

To use the 12-pitch Courier in the LaserJet III or 4 series, use 12h instead of 10h.

To set the default left margin to 1 inch, copy to the printer a file containing these characters:

```
Esc &a10L
```

◆ **IBM Graphics Characters for a PrtSc** For all the LaserJet series' default settings, a PrtSc produces characters you don't expect when the screen contains IBM graphics characters. You can fix this by using the front panel to change the default symbol set to PC-8. Take the printer off-line, press the control panel's Menu key until you reach "Symbol Set=", then press the Plus sign key until you reach PC-8. Now press the Enter key, and then the On-Line key.

You can also do this temporarily by copying to the printer—any laser that has this problem, not just the LaserJets—a file containing these characters:

```
Esc (10U
```

◆ **Useful Escape Sequence** These escape sequences can be used for the LaserJet Series II and later models:

Manual envelope feed tray:

```
Esc &l3H
```

Envelope-size to standard business:

```
Esc &l2A
```

Landscape mode:

```
Esc &l1O
```

Portrait mode:

```
Esc &l0O
```

Page length (in lines):

```
Esc &l#P
```

(# is the number of lines.)

Orthogonal printing:

```
Esc &#P
```

(# is 90, 180, or 270, and refers to the degrees of rotation. Other values may be used, but they will work only in 90-degree increments.)

◆ **Reading List** For ongoing tips, check periodicals such as the independently published *LaserJet Journal* (Northbrook, Illinois). Other useful sources:

- *LaserJet Companion* (up to LaserJet IIID), Second Edition, by The Cobb Group (Mark W. Crane, Joseph R. Pierce, and David Holzgang); $27.95; Microsoft Press (800-677-7377).
- *The LaserJet Handbook* (LaserJet II, IID, IIP), Second Edition, by Steven J. Bennett and Peter G. Randall; $24.95, or $39.95 with utility disk; Brady Books, Prentice Hall Computer Publishing (800-428-5331).
- *The LaserJet III Companion* (LaserJet IID, III), by Steven J. Bennett and Peter G. Randall; $34.95 (includes utility disk); Brady Books, Prentice Hall Computer Publishing (800-428-5331).
- *LaserJet Unlimited* (up to LaserJet II), Second Edition, by Ted Nace and Michael Gardner; $24.95; Peachpit Press (800-283-9444).
- *The Laser Printer Handbook* (up to LaserJet II), by David Myers; $29.95; Business One (800-634-3966).
- *The Little LaserJet Book* (up to LaserJet IIP and LaserJet III), by Steve Cummings; $14.95; Peachpit Press (800-283-9444).

Then, next to Auto Underline Off, type hpundoff. Next to Vertical Movement, type 30. (Or experiment with other numbers until you find the one that gives the results that look best to you.) Now press F7 until you reach the prompt that asks if you want to save your changes. Now, in WordPerfect, select Print (Shift-F7), Select, and Update; then press F7 until you return to the editing screen.

Now, in WordPerfect, select *Print* (Shift-F7), *Select*, and *Update;* then press F7 until you return to the editing screen.

◆ **Letterhead in the Lower Tray, Plain White in the Upper** Under WordPerfect, you can use, on the same print job, the HP LaserJet IIP or IIIP's optional lower tray for regular paper and the built-in tray for letterhead sheets. To accomplish this trick, first choose Print (Shift-F7), Select, and Edit. On the menu that appears, choose Sheet Feeder, and then select the LaserJet IIP or IIIP. Press the F7 key until you return to the editing screen.

Now select Format (Shift-F8), Page, and Paper Size. The highlight should be on Standard. Select Edit, Location, Bin Number, and enter 2. This selects the lower tray for standard pages. Press F7 or Enter to return to the previous menu, and then select Add, Letterhead, Location, and Bin Number, and enter 1. This selects the built-in tray for letterhead. Press Enter or F7 until you return to the editing screen.

Insert your letterhead in the built-in tray, then select Format, Page, Paper Size. Select Letterhead, and then return to the editing screen. Anywhere below the first line, select Format, Page, Paper Size, Standard. (You can enter all these codes in Initial Codes from the Format menu and make them appear automatically in every document you create.) The first page will print on letterhead, and all subsequent pages will print from the ordinary paper in the lower tray.

For this to work, you have to set the printer's control panel correctly. The correct settings are listed in the help screen that WordPerfect displays when you select the Sheet Feeder.

The same trick works with the two built-in trays on the HP LaserJet IID and IIID. Follow similar procedures within WordPerfect and on the printer's control panel.

Correcting Common Errors

◆ **Toner Low** Output quality suffers when the toner gets low. Some lasers include a system to alert you to the amount of toner left in the cartridge; for example, a "TONER LOW" message will appear when the toner level reaches a certain point on the cartridge of a LaserJet II (or later model).

One trick you can try to extend the life of most laser printers' toner cartridges (if they're easily accessible) is to remove them and shake them. This may redistribute the toner sufficiently to turn such a message off. Note that each time you do this, you are likely to reach the "TONER LOW" condition more quickly, and are at risk of further reducing the quality of output. Some users open a new cartridge at this time and use it only for final prints, while keeping the old cartridge for drafts until the toner has been completely exhausted. If you follow this route, be sure to keep the new cartridge in its plastic bag and away from light when not in use. Careful handling can prevent damage that could ruin the new cartridge.

If you insert a new cartridge and still get a "TONER LOW" message, the most likely causes are damaged contacts either in the printer or on the cartridge. The easiest solution is to try another new cartridge first; if it works, then the first cartridge was probably defective. If the second new cartridge also results in a "TONER LOW," then the printer is the source of the problem.

◆ **Overflow Error** HP LaserJet–series printers produce two different error messages related to memory. A "20 ERROR" ("20 MEM OVERFLOW" in the LaserJet III family) means that the printer has received more data than it can hold in memory. You can salvage the print job by removing the partially printed page, placing it faceup in the manual-feed tray, and pressing the Continue button on the LaserJet's front panel. The printer will then print the remainder of the page. You probably won't get perfect alignment between the two portions, but the output will at least be legible. You can permanently solve the problem either by printing at a lower resolution (150 dots per inch) or by adding memory to your printer. This condition can also occur when you have extra memory but so many downloaded fonts and printer macros that there is still insufficient memory for the page image. In this case, clear the downloaded fonts by turning the printer off and on again, then rerunning the print job.

The other error, "21 ERROR" ("21 PRINT OVERRUN" on the LaserJet III series), indicates that too much data has been sent, resulting in a page too complex for the printer's controller to interpret. You can press the Continue button on the front panel to print as much of the page as the controller can handle, but you'll probably have to simplify the page before printing the whole thing.

The LaserJet III series provides you with an option that can sometimes solve the problem. It lets you reassign the printer's memory. This works only if you have more than 1MB of RAM installed; 4MB or 5MB is recommended. On the printer control panel, hold down the Menu key for about 5 seconds until "AUTO CONT=OFF" appears. Then press the Menu key again until you see "PAGEPROTECT=OFF." Press the Plus sign key until you reach LTR or LGL (depending on whether you use letter- or legal-size paper), press the Enter key, and then press the On-Line key. The printer will reset, and you'll be able to print graphics successfully.

Customizing Your LaserJet

◆ **66 Lines Instead of 60** Many ASCII files formatted for dot matrix printing are formatted at 66 lines to the page. When you print these on a laser printer, you normally get one page with 60 lines followed by a second page with 6 lines, instead of a single page with 66 lines. To make a LaserJet–series printer default to 66-line printing, take it off-line, hold down the Menu button, then press the Menu button repeatedly until you see "Form=60 lines." Press the Plus sign key six times, then press the Enter and On-Line buttons.

To get the same effect temporarily without pressing the control panel, use a text editor that lets you enter the Escape character (ASCII 27) and create a file containing the following codes (don't insert any spaces or a carriage return):

```
Esc &l1e7.64c66F
```

Then copy this file to LPT1 (or whichever port your printer is attached to). These codes change the top margin to 1 line, reduce the line height, and set the page length to 66 lines. (Obviously, this trick can be used with printers other than the LaserJet series.)

Dingbats. An optional $129 font ROM adds 46 scalable and 8 bitmapped fonts. Two slots will let you plug in two standard font cards with up to 4MB of custom fonts, graphics, and logos; Kyocera plans to ship proprietary cards sometime in the future.

Diablo 630, Epson, and IBM Proprinter emulations come built-in; a $399 ROM will provide Kyocera's clone version of Adobe PostScript Level 1, but it wasn't ready for testing by PC Magazine Labs. The printer also uses Kyocera's proprietary PDL Prescribe II page description language, a remarkably straightforward language with simple commands for normally complex functions such as printing pie charts. Prescribe II can also generate 42 types of bar codes, including Postnet.

The Ecosys doesn't automatically switch emulations, but it can accept data from multiple inputs simultaneously. Network interfaces for AppleTalk ($199), Ethernet ($699), and Token-Ring ($899) should be out by the time you read this.

You can upgrade the printer's 1MB of RAM to a total of 5MB, but you'll have to buy a $269 board (which comes with 1MB) and then add proprietary 1MB SIMMs ($169 each).

The Ecosys is an innovative printer that lets you print at an impressively low cost, with good speed. And if you worry about the ecological effect of mountains of abandoned toner cartridges, the Ecosys may let you breathe more easily.

Kyocera Electronics Inc., *100 Randolph Rd., Somerset, NJ 08875; 800-621-6777, 908-560-3400; fax, 908-560-4626.*

EDITORS' CHOICE ▶ Kyocera Ecosys a-Si Printer FS-1500A *List price: $2,395; memory expansion board with 1MB, $269; 1MB RAM upgrade, $169; Kyocera PostScript emulation, $399; Font ROM, $129; 500-sheet second paper cassette, $499; 250-sheet A4-size paper cassette, $48; envelope feeder, $199; 500-sheet output tray, $229; duplex module, $699, 15-bin sorter, $1,995; toner, $39; AppleTalk interface, $199; Ethernet interface, $699; Token-Ring interface, $899. Dimensions (HWD): 8.7 x 13.6 x 13.8 inches. Weight: 29.8 pounds. Emulations: Diablo 630, Epson FX, Epson LQ, Epson MX, HP PCL 5, IBM Proprinter.*
Circle 486 on reader service card

LaserMaster Corp.

LaserMaster Unity 1000
LaserMaster Unity 1200xl
LaserMaster WinPrinter 800

BY MITT JONES

LaserMaster is known for coaxing camera-ready output from mainstream laser engines—for a price. The $6,995 LaserMaster Unity 1000 and the $9,995 large-media LaserMaster Unity 1200xl carry on this tradition. The $1,595 LaserMaster WinPrinter 800 represents LaserMaster's other interest—host-based printing.

Each uses LaserMaster's Enhanced TrueImage PostScript interpreter, has PCL 4, and offers PostScript output at resolutions well beyond 300 dpi: The number in the products' names signify their top resolution, achieved partly with LaserMaster's TurboRes resolution enhancement technique.

LASERMASTER UNITY 1000

Based on a 400-dpi Canon SX engine, the 8-page-per-minute Unity 1000 achieves its 1,000-dpi horizontal resolution by boosting the rate at which the laser turns on and off as the beam travels across the drum. TurboRes boosts claimed effective vertical resolution from 400 dpi to 1,000 dpi. Under PostScript, the printer also offers a 400-by-400 "proof" mode. As with the Unity 1200xl, PCL 4 limits the system to only 300 dpi in that mode.

LaserMaster Unity 1000, LaserMaster WinPrinter 800, LaserMaster Unity 1200xl

With TurboRes, even italic fonts scrutinized through a strong magnifying glass look spectacular: They have smooth edges and almost no jaggies. Together with LaserMaster's TurboGray contour smoothing algorithms, half-tone image quality is also considerably improved.

The $6,995 Unity 1000 (with a street price near $6,000) has a few other goodies. For the Unity 1000 and the Unity 1200xl, a 20MB internal hard disk comes with 135 preinstalled, Type 1 font outlines—the MasterWorks Type Library, by Digital Typeface Corp.—and leaves room for another 200 or so. Both printers support automatic emulation sensing and automatic interface switching among the standard parallel, serial, and AppleTalk ports (or the optional $795 Ethernet interface). The Unity 1000 comes with a tray for 200 letter-size sheets.

The Unity 1000 control board holds a 32-bit processor and a floating-point coprocessor, both running at 40 MHz and both of which LaserMaster declined to identify. The board comes with 9MB of RAM (expandable to 48MB) and a 32K static-RAM cache.

At its lowest resolutions, the Unity 1000 handled 7.0 ppm (PCL mode) and 7.5 ppm (PostScript mode). With graphics, it scored 2.3 gppm (PCL mode). Its PostScript Graphics Speed score of 1.1 gppm tied with the NewGen TurboPS/880's for first place.

The Unity 1000 accepts standard toner cartridges, but you'll probably want to use LaserMaster's $195 microfine toner cartridge for the best results. This cartridge yields a hefty cost per page of 6.5 cents, however, more than twice the cost of most regular printers.

The Unity 1000 has its flaws, including the lack of a control panel—you set all configuration options through a menu-driven utility—and its inability to pass our PCL 4 Torture Test. (According to the company, a downloadable fix should be available in November.) The printer also failed to respond to requests to change resolutions under Windows.

Not everybody needs a 1,000-dpi, plain-paper typesetter, but for users who need top-quality camera-ready copy, the LaserMaster Unity 1000 from LaserMas-

ter offers plenty of features, and it boasts an attractive price.

LASERMASTER UNITY 1200xl

The $9,995 Unity 1200xl, which should sell for as low as $8,995, resembles the Unity 1000 in features but builds on a 600-dpi large-media Toshiba engine. The Unity 1200xl offers a 600-dpi proof mode and a claimed effective resolution via TurboRes of 1,200 by 1,200 dpi.

The Unity 1200xl packs more processing power than the Unity 1000 and provides more flexible paper handling. You get a 33-MHz processor with a built-in coprocessor, a 40K cache, and 21MB of RAM (also expandable to 48MB). A 150-sheet cassette holds paper up to 11.7 by 17.7 inches.

During testing, the Unity 1200xl generated crisp, smooth text; edges were a bit smoother than with the Unity 1000.

Though rated at 6 ppm for letter-size paper in portrait orientation, the Unity 1200xl gets a speed boost—and its 8-ppm rating—from its ability to accommodate letter-size paper sideways. The unit we tested was able to print in landscape mode only under PostScript, however; the company couldn't solve the problem.

With the Unity 1000's TurboRes technology, even italic fonts scrutinized through a strong magnifying glass look spectacular.

In 300-dpi portrait mode, the Unity 1200xl scored 4.4 text ppm under PCL—slow even for its 6-ppm rating in that mode. Its Text Speed score of 6.2 ppm under PostScript in landscape mode was better but not up to the speeds of many 8-ppm competitors. Graphics scores in both modes were more in line with the rest, with its 2.1 gppm PCL score in portrait mode admirable for its 6-ppm rating.

One drawback of the Toshiba engine is its relatively light duty cycle (3,000 pages per month, compared with 20,000 for the IBM LaserPrinter 10P). This may make the Unity 1200xl unsuitable for high-volume applications.

If you need camera-ready copy on different paper sizes, including 11 by 17, the Unity 1200xl may be worth a closer look.

LASERMASTER WINPRINTER 800

Like the now-discontinued WinPrinter 400 we saw last year, the 4-ppm WinPrinter 800 (under $1,300 on the street) is a host-based printer that leaves its brainwork up to the PC. Unfortunately, the host-based implementation still needs some work.

Like the earlier model, the WinPrinter 800 is based on the 400-dpi Canon LX engine and lacks any processing capability or memory of its own, as does the 16-bit video interface board. The WinPrint Manager, which runs as a Windows app on the host system, provides the smarts. The included 50 TrueType and 50 Type 1 fonts (a total of 85 distinct font outlines)

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▶ SUMMARY OF FEATURES

Mainstream Lasers

Products listed in alphabetical order

■ = YES □ = NO

	Apple LaserWriter IIf	Apple LaserWriter IIg	Apple Personal LaserWriter NTR	Brother HL-4Ve	Brother HL-10V	C. Itoh ProWriter Desktop Laser Printer CI-8
List price	$3,299	$4,299	$2,199	$1,595	$1,995	$2,395
Engine						
Engine type	Laser	Laser	Laser	Laser	Laser	Laser
Model	Canon SX	Canon SX	Canon LX	Canon LX	Brother HL-10V	TEC 1323D
Rated speed (pages per minute)	8	8	4	4	10	8
Single-cartridge toner/developer/drum	■	■	■	■	■	□
Toner capacity (copies)	5,000	5,000	3,500	3,500	4,000	2,000
Total installable memory	32MB	32MB	4MB	5MB	5MB	5MB
Standard or proprietary	Standard (MAC-style)	Standard (MAC-style)	Standard	Standard	Standard	Proprietary
Maximum resolution (dpi)	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300
Processor on controller	20-MHz Motorola 68030	25-MHz Motorola 68030	16-MHz AMD 29005	16-MHz Motorola 68000	16-MHz Motorola 68000	16-MHz Intel 80960
RISC	□	□	■	□	□	■
Interfaces						
Parallel	□	□	■	■	■	■
Serial	■	■	■	■	■	■
Video	□	□	□	□	■	□
SCSI	■ (hard disk only)	■ (hard disk only)	□	□	□	□
AppleTalk	■	■	■	□	Optional	Optional
Ethernet	□	■	□	□	□	□
Token-Ring	□	□	□	□	□	□
Automatic interface switching	■	■	■	□	□	□
Simultaneously active ports	□	□	□	□	□	□
Paper Handling						
Capacity of each standard input cassette (sheets)	200	200	70	70	250	250
Output-tray capacity (sheets)	100	100	100	50	250	250
Duplexing	□	□	□	□	□	□
Rated maximum paper weight (pounds)	28	28	28	21	36	34
Fonts and Features						
HP PCL support	PCL 4	PCL 4	PCL 4	PCL 5	PCL 5	PCL 5
Accepts HP-compatible font cartridges	□	□	□	□	■	■
PostScript language support	Adobe PostScript Level 2	Adobe PostScript Level 2	Adobe PostScript Level 2	BR-Script (optional)	BR-Script (optional)	Destiny PDL (optional)
Number of Type 1 fonts supported	34	34	35	35	35	35
Supports automatic emulation switching	□	□	□	■	■	□
Supports resolution enhancement	■	■	□	■	■	■
Printer-specific Microsoft Windows 3.1 driver available	□	□	□	□	□	□
Number of LCD characters	N/A	N/A	N/A	16	16	16
Customer Support						
Toll-free technical support	□	□	□	■	■	■
Technical support hours (eastern time)	Dealer-dependent	Dealer-dependent	Dealer-dependent	9:00–4:30 M–F	9:00–4:30 M–F	11:30–8:00 M–F
BBS	□	□	□	□	□	■
Warranty (parts and labor)	1 year	1 year	1 year	1 year	1 year	2 years

N/A—Not applicable. The product does not have this feature. * This printer uses refillable toner and a permanently installed photoconductor and drum

	C. Itoh ProWriter Desktop Laser Printer CI-8E	Epson ActionLaser II	Epson EPL-8000	Fujitsu Print Partner 10	HP LaserJet 4	HP LaserJet 4M	HP LaserJet IIP Plus	Kyocera Ecosys a-Si Printer FS-1500A
				PC EDITORS' CHOICE	PC EDITORS' CHOICE	PC EDITORS' CHOICE		PC EDITORS' CHOICE
	$1,695	$999	$1,999	$1,995	$2,199	$2,999	$1,249	$2,395
	Laser	Laser	Laser	Laser	Laser	Laser	Laser	LED array
	TEC 1323CE	Ricoh LP-1200	Minolta NC-10	Minolta SP10	Canon P-270	Canon P-270	Canon LX	Ecosys
	8	6	10	10	8	8	4	10
	□	□	■	■	■	■	■	□*
	2,000	5,000	8,000	8,000	6,000	6,000	3,500	5,000
	5MB	5.5MB	7.5MB	9MB	34MB	26MB	4.5MB	5MB
	Proprietary	Standard	Standard	Standard	Standard	Standard	Standard	Proprietary
	300 x 300	300 x 300	300 x 300	300 x 300	600 x 600	600 x 600	300 x 300	300 x 300
	12-MHz Motorola 68000	14-MHz Motorola 68000	16.7-MHz Motorola 68000	15-MHz AMD 29005	20-MHz Intel 80960	20-MHz Intel 80960	16-MHz Motorola 68000	16-MHz Motorola 68000
	□	□	□	■	■	■	□	□
	■	■	■	■	■	■	■	■
	■	■	■	■	■	■	□	■
	□	□	□	□	□	□	□	□
	□	□	□	□	□	□	□	□
	□	□	□	Optional	Optional	■	□	Optional
	□	□	□	□	Optional	Optional	□	Optional
	□	□	□	□	Optional	Optional	□	Optional
	□	■	■	■	■	■	N/A	■
	□	■	■	■	■	■	N/A	■
	250	100	250	250	250, 100	250, 100	70	250
	250	50	150	150	250	250	50	250 (faceup), 250 (facedown)
	□	□	□	□	□	□	□	Optional
	34	42	42	41	28	28	28	24
	PCL 5	PCL 4	PCL 5	PCL 5	Enhanced PCL 5	Enhanced PCL 5	PCL 4 (PCL 5 optional)	PCL 5
	■	■	■	■	■	■	■	□
	Destiny PDL (optional)	Adobe PostScript (optional)	Adobe PostScript (optional)	Microsoft TrueImage (optional)	Adobe PostScript Level 2 (optional)	Adobe PostScript Level 2	Adobe PostScript (optional)	Kyocera PDL (optional)
	35	35	35	35	35	35	35	47
	□	□	■	■ (via software)	■	■	□	□
	■	□	■	■	■	■	□	■
	□	□	□	□	■ (included)	■ (included)	■ (in Windows 3.1 and via BBS)	■**
	16	20	20	16	20	20	20	32
	■	■	■	■	□	□	□	■
	11:30–8:00 M–F	8:00 A.M.–11:00 P.M. M–F	8:00 A.M.–11:00 P.M. M–F	9:00–8:00 M–F	9:00–8:00 M, T, Th, F; 9:00–6:00 W	9:00–8:00 M, T, Th, F; 9:00–6:00 W	9:00–8:00 M, T, Th, F; 9:00–6:00 W	6:00 A.M.–6:00 P.M. M–F
	■	■	■	■	■	■	■	■
	2 years	1 year	1 year	1 year	1 year	1 year	1 year (3 years on LED array and drum)	1 year

**The Windows driver was not available for testing.

CONTINUES

Witnessed

single FileMaker Pro database across a network of personal computers.

When an operator keys in the part number ordered by the customer, FileMaker Pro automatically goes to another file and brings back the name, description, price and availability of the product.

Not just limited to just information with other FileMaker Pro files. You can import data from and export data to a variety of other database and spreadsheet applications like Q&A, Paradox, dBASE, Excel and ASCII.

Which means information in another file simply bring it into your upgraded FileMaker Pro for Windows.

Introducing The New For Database Windows.

1-800-3-CLARIS.

Check the inventory.

Simply powerful software.

Video Demo

Macintosh computers.

Call us or mail the coupon today. We'll show you a database that will make you a power user with point and click.

FileMaker Pro

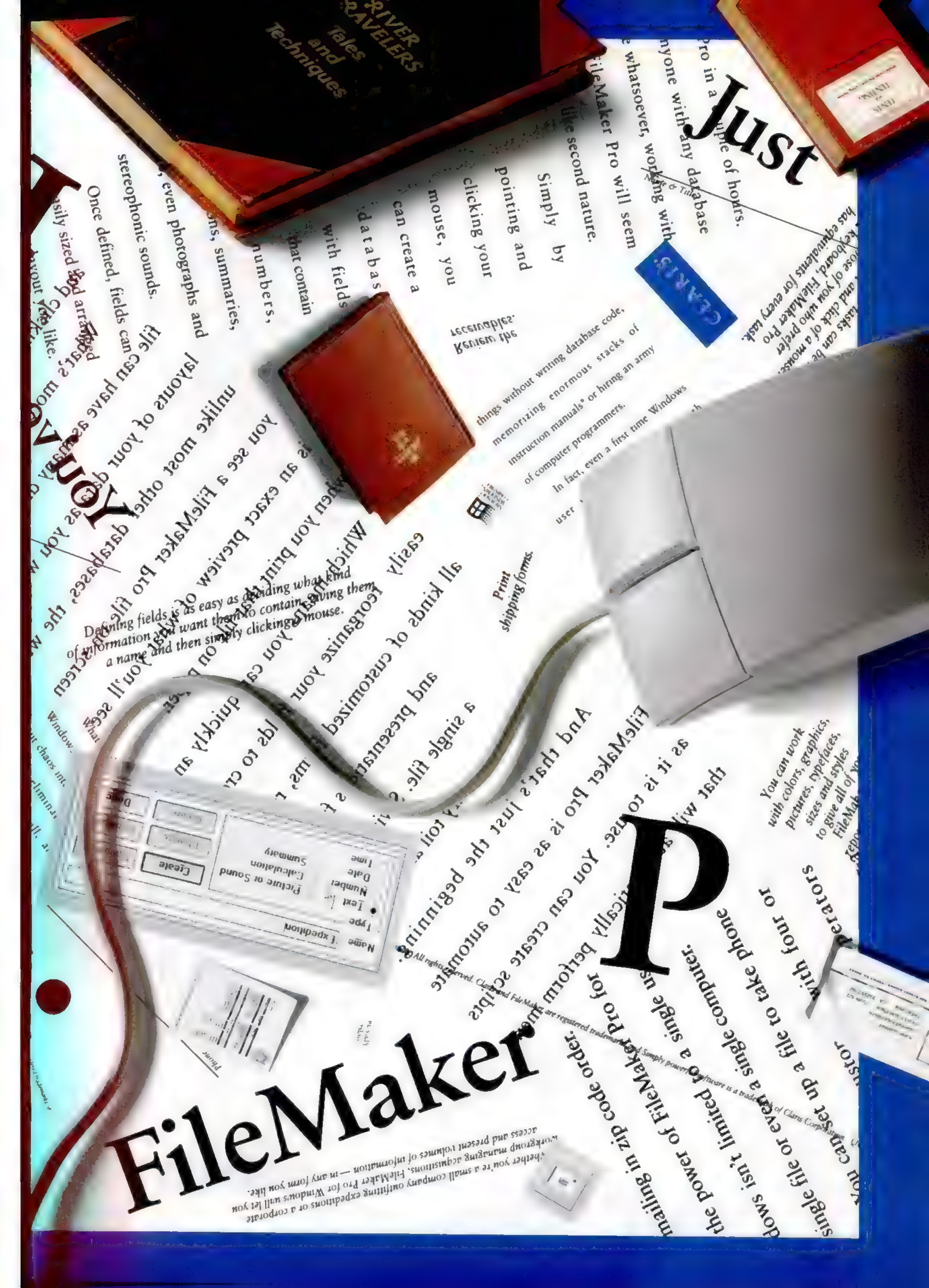
You can create styles and type sizes. All by simply pointing and clicking.

Or mail this coupon to FileMaker Pro, c/o Claris Corporation, C/11, Box 58160, Santa Clara, CA 95052-8160. In Canada, call 1-800-387-8019.

Accessible could create a state of the art database or a simple address book. For example, the author of this page, who is a FileMaker Pro user, could have gotten his first time, every time. Simply added from one of more than 50 standard library sets.

Print perfect labels, envelopes, and business cards.

CLARIS



Just
Your
FileMaker
P
Tales and Techniques
CARDS
Simply by pointing and clicking your mouse, you can create a database with fields
things without writing database code, memorizing enormous stacks of instruction manuals or hiring an army of computer programmers.
In fact, even a first time Windows user
Print shipping forms.
You can work with colors, graphics, pictures, typefaces, sizes and styles
Once defined, fields can be easily sized and arranged
stereophonic sounds.
And that's just the beginning.
FileMaker Pro is as easy to use as it is to
You can create scripts that automatically perform
mailing in zip code order.
the power of FileMaker Pro for a single user
dows isn't limited to a single computer.
single file or even a file to take phone
whether you're a small company outfitting expeditions or a corporate workgroup managing acquisitions, FileMaker Pro for Windows will let you access and present volumes of information — in any form you like.
Name
Type
Text
Number
Date
Time
Picture or Sound
Calculation
Summary
Create

I cla

c k l

You've Just Witnessed The *Power* Of FileMaker Pro.

What makes FileMaker®Pro for Windows so powerful isn't its ability to put chaos into order, simplify complex jobs or eliminate repetitive tasks. After all, any truly sophisticated database can do all of that and more.

The power of FileMaker Pro is that it lets you do all of these things without writing database code, memorizing stacks of instruction manuals or hiring an army of expensive computer programmers.

In fact, even a first time Windows user will feel comfortable with FileMaker Pro in a couple of hours. And for anyone who has any kind of database experience whatsoever, working with FileMaker Pro for Windows will seem like second nature.

Whether you're a small company outfitting expeditions or a corporate workgroup managing acquisitions, FileMaker Pro for Windows will let you access and present volumes of information — in any form you like.

Simply by pointing and clicking a mouse, you can create database fields that contain numbers, text, dates, calculations, summaries, graphics, times, even photographs and stereo sounds.

Check the inventory.

Once defined, fields can be easily sized and arranged on your screen in any layout you like. You can assign colors, typefaces, type-styles and type sizes. All by (yo guessed it) simply pointing ar clicking your faithful mouse.

What's more, every FileMak Pro file can have as many di ferent views or layouts of yo data as you want. And unlik most other databases, the wa you see a FileMaker Pro file c screen is an exact preview what you'll see when you pri that file on paper.

Review t receivabl

Which means you can simply reorganize your fields to create all kinds customized forms, reports ar presentations from just a sing file. Saving you many hours unnecessary toil and labor.

And that's just the beginnin

Print perfect labels first time, every time. Simply select from one of more than 50 standard Avery sizes.

FileMaker Pro isn't limited to Windows. It's also available in a Macintosh version. Which means all nice point to FileMaker Pro - no matter what kind of personal computer you work with.

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eMaker Pro is as easy to auto-
ıte as it is to use. You can cre-
: scripts that automatically
rform menu operations,
ıdate files, run pre-defined
rts, generate reports or
automate virtually any
other job imaginable.

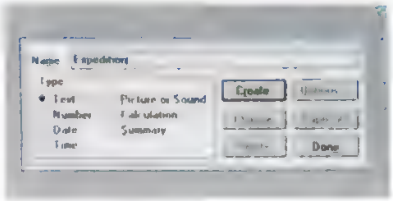
lace an rder.

For example, the
lks in Accounts Receivable

You can work b colors, graphics, ctures, typefaces, sizes and styles give all of your FileMaker Pro ports a polished, ofessional desktop published look

uld create a script instructing
leMaker Pro to search for
stomers with overdue balances,
corporate that data into fully
ersonalized form letters
emanding payment in a firm
ıt friendly tone) and gener-
e a mailing in zip code order.

And the power of FileMaker Pro isn't limited to a single file, a



Defining fields is as easy as deciding what information you want them to contain, selecting a name and clicking a mouse.

single user or a single computer.

You can set up a file to enter phone orders from customers with four or five operators sharing a FileMaker Pro database across an office network of PCs and Macs. When an operator keys in the part number ordered by the customer, FileMaker Pro automatically goes to another file and brings back the name, description, price and current availability of the product specified.

Print a shipping form.

Nor is FileMaker Pro limited to just sharing information with other FileMaker Pro files. You can import data from and export data to a variety of other database and spreadsheet applications like Q & A,, Paradox, dBASE, 1-2-3, Excel and a host of others. So you can easily bring all of your information along with you when you move up to FileMaker Pro for Windows.

Call us toll free or fill out and mail the coupon today.

And let us show you a truly sophisticated Windows database that will make you a power user with just a click of a mouse.

Introducing The New Database For Windows.

For A *Free* FileMaker Pro *Video* Demo
1-800-3-CLARIS, ext. 25
Or mail this coupon to: FileMaker Pro Video, Claris Corporation, Department C-11, Box 58169, Santa Clara, California 95052. In Canada, call 1-800-387-8034, ext. 150.

Name & Title
Company
Address
City *State* *Zip*
Phone

☐ Yes, I currently own a DOS or Windows database.

CLARIS
Simply powerful software.™

CIRCLE 178 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

Mainstream Lasers

Products listed in alphabetical order

■ = YES □ = NO

	Apple LaserWriter IIf	Apple LaserWriter IIg	Apple Personal LaserWriter NTR	Brother HL-4Ve	Brother HL-10V	C. Itoh ProWriter Desktop Laser Printer CI-8
List price	$3,299	$4,299	$2,199	$1,595	$1,995	$2,395
Engine						
Engine type	Laser	Laser	Laser	Laser	Laser	Laser
Model	Canon SX	Canon SX	Canon LX	Canon LX	Brother HL-10V	TEC 1323D
Rated speed (pages per minute)	8	8	4	4	10	8
Single-cartridge toner/developer/drum	■	■	■	■	■	□
Toner capacity (copies)	5,000	5,000	3,500	3,500	4,000	2,000
Total installable memory	32MB	32MB	4MB	5MB	5MB	5MB
Standard or proprietary	Standard (MAC-style)	Standard (MAC-style)	Standard	Standard	Standard	Proprietary
Maximum resolution (dpi)	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300
Processor on controller	20-MHz Motorola 68030	25-MHz Motorola 68030	16-MHz AMD 29005	16-MHz Motorola 68000	16-MHz Motorola 68000	16-MHz Intel 80960
RISC	□	□	■	□	□	■
Interfaces						
Parallel	□	□	■	■	■	■
Serial	■	■	■	■	■	■
Video	□	□	□	□	■	□
SCSI	■ (hard disk only)	■ (hard disk only)	□	□	□	□
AppleTalk	■	■	■	□	Optional	Optional
Ethernet	□	■	□	□	□	□
Token-Ring	□	□	□	□	□	□
Automatic interface switching	■	■	■	□	□	□
Simultaneously active ports	□	□	□	□	□	□
Paper Handling						
Capacity of each standard input cassette (sheets)	200	200	70	70	250	250
Output-tray capacity (sheets)	100	100	100	50	250	250
Duplexing	□	□	□	□	□	□
Rated maximum paper weight (pounds)	28	28	28	21	36	34
Fonts and Features						
HP PCL support	PCL 4	PCL 4	PCL 4	PCL 5	PCL 5	PCL 5
Accepts HP-compatible font cartridges	□	□	□	□	■	■
PostScript language support	Adobe PostScript Level 2	Adobe PostScript Level 2	Adobe PostScript Level 2	BR-Script (optional)	BR-Script (optional)	Destiny PDL (optional)
Number of Type 1 fonts supported	34	34	35	35	35	35
Supports automatic emulation switching	□	□	□	■	■	□
Supports resolution enhancement	■	■	□	■	■	■
Printer-specific Microsoft Windows 3.1 driver available	□	□	□	□	□	□
Number of LCD characters	N/A	N/A	N/A	16	16	16
Customer Support						
Toll-free technical support	□	□	□	■	■	■
Technical support hours (eastern time)	Dealer-dependent	Dealer-dependent	Dealer-dependent	9:00–4:30 M–F	9:00–4:30 M–F	11:30–8:00 M–F
BBS	□	□	□	□	□	■
Warranty (parts and labor)	1 year	1 year	1 year	1 year	1 year	2 years

N/A—Not applicable: The product does not have this feature * This printer uses refillable toner and a permanently installed photoconductor and drum

PC EDITORS' CHOICE							
NEC Silentwriter Model 95	**NewGen TurboPS/300p**	**NewGen TurboPS/400p**	**NewGen TurboPS/630En**	**NewGen TurboPS/660**	**NewGen TurboPS/840e**	**NewGen TurboPS/880**	**Okidata OL810 LED Page Printer**
$1,749	$1,995	$2,595	$3,595	$3,495	$3,995	$4,795	$1,699
Laser	Laser	Laser	Laser	Laser	Laser	Laser	LED array
Minolta	Canon LX	Canon LX	Canon SX	Canon SX	Canon SX	Canon SX	Oki Electric OL800
6	4	4	8	8	8	8	8
■	■	■	■	■	■	■	□
8,000	3,500	3,500	4,000	4,000	4,000	4,000	2,500
5MB	16MB	16MB	32MB	32MB	32MB	32MB	5MB
Proprietary	Proprietary	Proprietary	Proprietary	Proprietary	Proprietary	Proprietary	Proprietary
300 x 300	300 x 300	400 x 400	600 x 300	600 x 600	800 x 400	800 x 800	300 x 300
16.7-MHz Motorola 68000	16-MHz Weitek XL-8220	16-MHz Weitek XL-8220	25-MHz Weitek XL-8220	25-MHz Weitek XL-8220	25-MHz Weitek XL-8220	25-MHz Weitek XL-8220	12-MHz Motorola 68000
□	■	■	■	■	■	■	□
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	Optional
□	□	□	□	□	□	□	□
□	Optional (hard disk only)	Optional (hard disk only)	■ (hard disk only)	■ (hard disk only)	■ (hard disk only)	■ (hard disk only)	□
■	■	■	■	■	■	■	Optional
Optional	□	□	■	Optional	Optional	■	□
□	□	□	□	□	□	□	□
■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■
250	70	70	200	200	200	200	200
150 (faceup), 50 (facedown)	70 (faceup), 20 (facedown)	70 (faceup), 20 (facedown)	100 (faceup), 20 (facedown)	100 (faceup), 20 (facedown)	100 (faceup), 20 (facedown)	100 (faceup), 20 (facedown)	200
□	□	□	□	□	□	□	□
41	28	28	35	35	35	35	24
PCL 5	PCL 4	PCL 4	PCL 4	PCL 4	PCL 4	PCL 4	PCL 5
■	□	□	□	□	□	□	□
Adobe PostScript Level 2	NewGen PDL	NewGen PDL	NewGen PDL	NewGen PDL	NewGen PDL	NewGen PDL	Adobe PostScript (optional)
39	35	35	35	35	35	35	Info not available
■ (via software)	■	■	■	■	■	■	□
■	□	■	□	■	■	■	■
■ (included)	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)
16	16	16	16	16	16	16	16
■	□	□	□	□	□	□	■
8:00 A.M.–8:00 P.M. M–F	9:30–8:00 M–F	9:30–8:00 M–F	9:30–8:00 M–F	9:30–8:00 M–F	9:30–8:00 M–F	9:30–8:00 M–F	8:00–6:00 M–F
■	■	■	■	■	■	■	□
1 year	1 year	1 year	1 year	2 years	1 year	1 year	1 year

CONTINUES

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Panasonic KX-P4410	Panasonic KX-P4430	Samsung Finalé 8000	TI microLaser Turbo	Toshiba PageLaser GX200	Xante Accel-a-Writer 8000
List price	$1,095	$1,495	$1,995	$1,749	$1,799	$3,295
Engine						
Engine type	Laser	Laser	Laser	Laser	Laser	Laser
Model	Panasonic 4400	Panasonic 4400	Samsung F8000	Sharp JX-9500	TEC LB-1323	Canon SX
Rated speed (pages per minute)	5	5	8	9	8	8
Single-cartridge toner/developer/drum	□	□	□	□	□	■
Toner capacity (copies)	3,000	3,000	5,000	3,000	3,000	4,000
Total installable memory	4.5MB	5MB	18MB	10.5MB	5MB	16MB
Standard or proprietary	Proprietary	Proprietary	Standard	Proprietary	Proprietary	Standard
Maximum resolution (dpi)	300 x 300	300 x 300	300 x 300 (600 x 600 with optional Image-Resolution Kit)	300 x 300	300 x 300	600 x 600
Processor on controller	15-MHz National Semiconductor 32 LG 16	15-MHz National Semiconductor 32 LG 16	16-MHz Intel 80960 KA	16-MHz Weitek 8220	16-MHz Motorola 68000	16-MHz AMD 29000
RISC	□	□	■	■	□	■
Interfaces						
Parallel	■	■	■	■	■	■
Serial	□	■	■	Optional	■	■
Video	□	□	■	□	□	□
SCSI	□	□	□	Optional (hard disk only)	□	■ (hard disk only)
AppleTalk	□	□	Optional	Optional	□	■
Ethernet	□	□	Optional	Optional	Optional	□
Token-Ring	□	□	Optional	□	Optional	□
Automatic interface switching	N/A	■	■	■	□	□
Simultaneously active ports	N/A	□	■	■	□	■
Paper Handling						
Capacity of each standard input cassette (sheets)	200	200	250, 250	250	250	200
Output-tray capacity (sheets)	100 (faceup), 20 (facedown)	100 (faceup), 20 (facedown)	250	250	250	100
Duplexing	□	□	□	□	□	□
Rated maximum paper weight (pounds)	35	35	35	34	32	36
Fonts and Features						
HP PCL support	PCL 4	PCL 5	PCL 5	PCL 4	PCL 5	PCL 4
Accepts HP-compatible font cartridges	■	■	■	■	■	□
PostScript language support	None	None	Samsung PDL	Adobe PostScript Level 2	Toshiba PDL (optional)	Phoenix
Number of Type 1 fonts supported	None	None	35	35	35	35
Supports automatic emulation switching	□	□	■ (via software)	■	□	□
Supports resolution enhancement	□	■	Optional	□	■	■
Printer-specific Microsoft Windows 3.1 driver available	■**	■**	■**	□	□	□
Number of LCD characters	16	16	16	16	16	16
Customer Support						
Toll-free technical support	■	■	■	□	■	■
Technical support hours (eastern time)	8:00–5:00 M–F	8:00–5:00 M–F	8:00–4:30 M–F	9:00–6:00 M–F	9:00–6:00 M–F	9:00–6:00 M–F
BBS	■	■	■	□	■	□
Warranty (parts and labor)	1 year	1 year	1 year (5 years on printhead)	1 year	1 year	1 year

N/A—Not applicable. The product does not have this feature. ** The Windows driver was not available for testing.

ENDS

FileMaker Pro
Just
mailing in zip code order.
the power of FileMaker Pro for
dows isn't limited to a single us
single file or even a single computer.
You can set up a file to take phone
with four or
perators
Name
Expedition
Type
Text
Number
Date
Time
Picture or Sound
Calculation
Summary
Create
Phone
Print
shipping forms.
You can work
with colors, graphics,
pictures, typefaces,
sizes and styles
to give all of you
FileMak
Designing fields is as easy as selecting what kind
of information you want them to contain, naming them
a name and then simply clicking the mouse.
mike most other database programs, the
You see a FileMaker Pro like
is an exact preview of what you'll see
Which kind of customized
easily reorganize your
all kinds of customized
and presentations
a single file.
And that's just the beginning.
FileMaker Pro is as easy to automate
as it is to use. You can create scripts
that will
things without writing database code,
memorizing enormous stacks of
instruction manuals or hiring an army
of computer programmers.
In fact, even a first time Windows
user
Keyboard, FileMaker Pro
has equivalents for every task.
Simply by
pointing and
clicking your
mouse, you
can create a
database
with fields
that contain
numbers,
stereophonic sounds.
Once defined, fields can
easily sized and arranged
FileMaker Pro will seem
like second nature.
RIVER
RAVELERS
Tales
and
Techniques

I cla

The ECOSYS a-Si Printer for the living world.

Only the Kyocera Corporation's dedication to preserving Earth's precious environment could have resulted in the ECOSYS™ amorphous silicon printer.

Drawing on its worldwide resources, Kyocera developed a new page printer with so radical a design … it totally eliminates the need for the over 16 million laser cartridges that conventional laser printers spew into the environment, every year.

ECOSYS doesn't use pollution causing cartridges. With ECOSYS, you're helping with the solution, not adding to the problem.

KYOCERA

ECOSYS a-Si PRINTER™

and the necessary software—including the PostScript interpreter—take up about 3MB on the host's hard disk.

As long as you stay within Windows and print from Windows applications—and your system can make at least 7MB of RAM available to Windows itself—the WinPrinter 800 works smoothly. Text and graphics output were nearly as impressive as those of the Unity models (all three share TurboRes resolution enhancement). But the performance boost from LaserMaster's Windows GDI direct driver is not what you might expect. While it easily outran the NewGen TurboPS/400p, it fell behind the Brother HL-4Ve and the HP LaserJet IIP Plus. To print from DOS applications, you have to choose one of two routes: running your DOS application in a DOS window under Windows or loading an expanded memory manager and a LaserMaster TSR before you print under straight DOS.

Using the TSR will limit you to the PCL 4 emulation, which failed our PCL Torture Test. If you run your DOS application under Windows, you'll find yourself hitting a user-definable hotkey to coax PCL 4 jobs out when they fail to print. When printing PostScript jobs in this way, operation is smooth but slow.

PostScript is the slower mode with this system—in fact, on our PostScript-mode Windows tests, it chalked up some of the slowest scores we saw.

The WinPrinter 800's excellent output and attractive price might tempt one to overlook its faults. But a better and faster solution is available: an 8-ppm HP LaserJet model coupled with LaserMaster's $795 WinJet 800 add-on. The WinJet 800—which provides the same video interface and software as the WinPrinter 800, minus the PCL 4 emulation—provides the smooth Windows PostScript operation of the WinPrinter 800 while leaving your LaserJet capable of providing fast, smooth DOS operation.

LaserMaster Corp., *6900 Shady Oak Rd., Eden Prairie, MN 55344; 800-950-6868, 612-944-9330; fax, 612-944-0522.*

LaserMaster Unity 1000 *List price: $6,995; 200-sheet paper cassette (legal- or A4-size), $79.95 each; microfine toner cartridge, $195; Ethernet interface, $795; 80MB SCSI hard disk, $1,195. Dimensions (HWD): 9.1 x 17.9 x 19 inches. Weight: 41 pounds. Emulations: HP PCL 4, LaserMaster Enhanced TrueImage PostScript interpreter.*

LaserMaster Unity 1200xl *List price: $9,995; 250-sheet paper cassette (letter-size), $179; 250-sheet paper cassette (legal-, A4-, or B-size), $179 each; second 250-sheet paper cassette, $549; 150-sheet multipurpose (envelope-, letter-, A4- legal-, or executive-size) feed bin, $449; drum, $699; microfine toner cartridge, $69; Ethernet interface, $795; TCP/IP interface, $1,195; 80MB SCSI hard disk, $1,195. Dimensions (HWD): 8.3 x 19.4 x 27.8 inches. Weight: 50.6 pounds. Emulations: HP PCL 4, LaserMaster Enhanced TrueImage PostScript interpreter.*

LaserMaster WinPrinter 800 *List price: $1,595; 200-sheet legal- or A4-size paper cassette, $79 each; 200-sheet letter-size paper cassette feed, $195; toner cartridge, $79.95. Dimensions (HWD): 8.75 x 13.6 x 28.4 inches. Weight: 24.2 pounds. Emulations: HP PCL 4, LaserMaster Enhanced TrueImage PostScript interpreter. Circle 487 on reader service card*

Lexmark International Inc.

IBM LaserPrinter 6P
IBM LaserPrinter 10P

BY MITT JONES

IBM LaserPrinter 6P, IBM LaserPrinter 10P

Excellent 300- and 600-dot-per-inch output, a mountain of paper-handling options, and brisk 10-page-per-minute performance won the IBM LaserPrinter 10 ($2,395) an Editors' Choice in our last printer issue. The IBM LaserPrinter 6 ($1,895), a 6-ppm printer based on the same 4029 engine, earned plenty of praise as well. The latest two printers from Lexmark International—an IBM alliance company—improve on their siblings by including Adobe PostScript Level 1 along with the necessary trimmings as standard fare.

The IBM LaserPrinter 6P ($2,295) comes with a 10-MHz Motorola 68000 processor, 2MB of RAM, and 17 resident PostScript outlines. The IBM LaserPrinter 10P ($3,795) offers a 16.7-MHz Motorola 68020 and 10-ppm performance. The 10P comes with an extra 3MB of RAM (5MB total) and 39 PostScript fonts. (You can upgrade last year's models to meet these configurations for about $400 and $300, respectively.)

HP PCL 5, which we didn't receive to test, is a $199 option for both new printers; a $399 font card will give the 6P the additional 22 PostScript outlines. As with last year's models, HPGL and PCL 4 are included. Both units require a TSR provided with the $29 Supplemental Utilities option to auto-switch emulations.

Each printer comes with a cassette that accommodates 200 sheets of letter-, executive-, A4-, or B5-size paper. A wide selection of paper-handling options, including a 500-sheet multipurpose cassette attachment ($449) and a 75-envelope feeder ($379), is available for both. The printers handle envelopes without a crease, thanks to a mechanism that forces air from them before they are passed through the rollers.

Each comes with a Fastbytes parallel port, capable of a continuous transfer rate of 70 kilobytes per second (KBps) and up to 150 KBps in burst mode. The IBM 4033 LAN Connection box can provide network connections for the 4029 series printers or any parallel printer. LAN Connection Model 12 (Ethernet over 10BaseT for NetWare) costs $695, and other models are available.

The 6P and 10P generate surprisingly good 300-dpi text and line art, thanks to IBM's PQET (Print Quality Enhancement Technology). Each unit can also print at a true resolution of 600 by 600 dpi—but you'll have to bring the 6P up to at least 5MB of RAM. They support up to 9MB, but IBM's proprietary mem-

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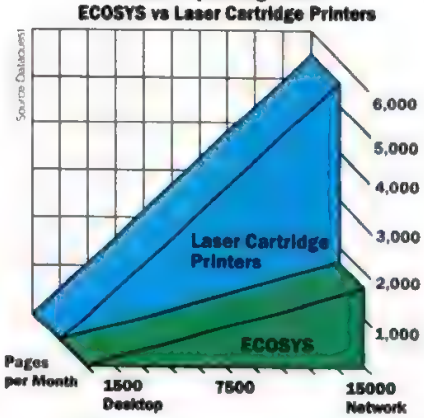
Annual Operating Costs—ECOSYS vs Laser Cartridge Printers



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KYOCERA

Kyocera Electronics, Inc. 100 Randolph Road, Somerset NJ 08875

CIRCLE 370 ON READER SERVICE CARD

ory modules are costly: $199 for 1MB, $399 for 2MB, or $799 for 4MB.

Both come with a Microsoft Windows GDI Print Accelerator driver (developed in conjunction with LaserMaster Corp.) that can provide a speed boost in that environment but supports only 300-dpi printing. On our CorelDRAW tests in Windows, they bested their respective peers, if not always by a large margin. This was not always the case on the Word for Windows test, though.

IBM LASERPRINTER 6P

Priced as low as $1,550 on the street, the LaserPrinter 6P goes fairly easy on the wallet for a PostScript printer.

You can boost the 6P to the speed of the 10P with a $799 controller upgrade. On its own, this 6-ppm unit delivered steady performance during speed testing. In PCL 4 mode, the 6P handled text at 5.8 ppm and graphics at 1.8 graphics pages per minute; it clocked in at 5.5 ppm and 0.4 gppm in PostScript mode. As a low-end PostScript printer, the 6P should prove an attractive buy, especially with its print quality and expandability.

IBM LASERPRINTER 10P

The 10-ppm high-end LaserPrinter 10P, which should sell at discounted prices of as low as $2,600, is a quick PostScript printer small enough to sit on a desktop.

The 10P did well on our Text and Graphics Speed tests, though it wasn't the fastest of its class. In PCL 4 mode, it had a text score of 9.1 ppm and a graphics score of 2.4 gppm. Under PostScript, however, the printer led its desktop competition when printing text at 300 dpi, clocking in at 8.8 ppm; its 0.7-gppm performance is nothing to look down on. At 600-dpi, its graphics score in informal tests dropped to 0.3 gppm, as expected for the higher resolution.

The 10P's high-resolution text output can't quite match that of the LaserMaster offerings reviewed here, but the difference is unnoticeable to the naked eye. With PostScript graphics at 600 dpi, the 10P did a nice job of ramping from one gray scale to another. As with other high-resolution printers, PCL 4 jobs are limited to a 300-dpi resolution.

The 10P comes with a 250-sheet output bin (the 6P's holds 100 sheets) and provides a sensor for automatic shutdown when the bin becomes full.

The IBM LaserPrinter 10P should prove a good choice for high-volume applications, at least with the optional automatic emulation switching. More expensive printers such as the LaserMaster offerings can deliver better output quality, but the 10P's 600-dpi output is still impressive and should suffice for most as camera-ready output.

Lexmark International Inc., *740 New Circle Rd., Lexington, KY 40511; 800-426-2468.*

IBM LaserPrinter 6P *List price: $2,295; 1MB RAM upgrade, $199; 2MB RAM upgrade, $399; 4MB RAM upgrade, $799; HP PCL 5 emulation, $199; PostScript font card, $399; additional font cartridges, $142 to $245 each; 200-sheet multipurpose paper cassette (letter-, A4-, executive-, B5-size), $69; 200-sheet legal-size multipurpose paper cassette, $79; 200-sheet A5-size cassette, $109; 500-sheet second multipurpose paper cassette feed (letter-, A4-, B5-, executive-size), $449; additional 500-sheet multipurpose paper cassette, $129; 500-sheet legal-size multipurpose paper cassette, $139; heavy-duty label/card stock tray, $69; envelope feeder, $379; toner cartridge, $199; high-yield toner cartridge, $259; AppleTalk interface, $399; Token-Ring interface, $945; IBM 4033 LAN Connection Models 12 and 13 (Ethernet for Novell networks), $695; IBM 4033 LAN Connection Models 2 and 3 (for OS/2 LANServer, Microsoft LanMan, and AIX), $845; Supplemental Utilities, $29; parallel cable, $47; proprietary serial cable, $58; IBM Serial Interface Adapter, $38. Dimensions (HWD): 11.8 x 14.2 x 20.9 inches. Weight: 33 pounds. Emulations: Adobe PostScript, HPGL, HP PCL 4.*

EDITORS' CHOICE ▶ IBM LaserPrinter 10P *List price: $3,795; no PostScript font card; other options are the same as for the LaserPrinter 6P. Dimensions: 11.8 x 14.2 x 20.9 inches. Weight: 33 pounds. Emulations: Adobe PostScript, HPGL, HP PCL 4.*
Circle 488 on reader service card

NEC Technologies Inc.

NEC Silentwriter Model 95

BY MITT JONES

With an aggressive $1,749 list price ($1,450 on the street) and numerous compelling features—including Adobe PostScript Level 2 and HP PCL 5 emulations—you would think the NEC Silentwriter Model 95 capable of winning over buyers without the help of some newfangled PostScript fax option. You'd probably be right. Of course, a powerful, convenient, ground-breaking option never hurts.

Based on a 300-dot-per-inch, 6-page-per-minute Minolta engine with a 16.7-MHz Motorola 68000 processor, the Silentwriter pursues the small-business market with handy features such as a 250-sheet letter-size cassette that fits underneath the printer. A hidden tray at the front pivots out to accommodate manual feed of cut sheets or automatic feed of up to 15 envelopes. A $349 bottom-feed multipurpose cassette holds 250 sheets.

The printer comes with 2MB of RAM standard, upgradable to 5MB via proprietary SIMMs ($399 for 2MB or $798 for 3MB). The unit furnishes the full collection of 39 Adobe scalable fonts. PCL 5 fonts include the expected 14 bitmapped and 8 scalable fonts. Two font slots accept HP-compatible cartridges.

Users in mixed and shared environments can switch automatically among the parallel, serial, and AppleTalk interfaces (as well as the $649 optional Ethernet connection). Emulation switching comes by way of LaserTools Corp.'s Printer Control Panel TSR; this uses about 5K of RAM.

NEC Silentwriter Model 95

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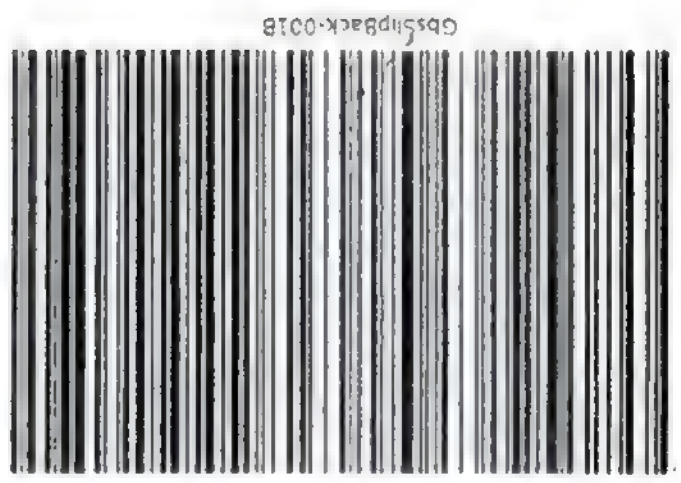
- Dual Floppy drive
- 64KB Static RAM Cache on motherboard

Inverted Back

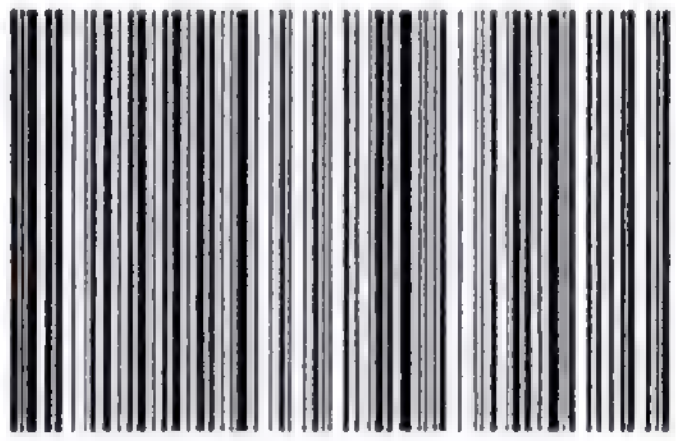
1. Follow instructions on the other side



Back

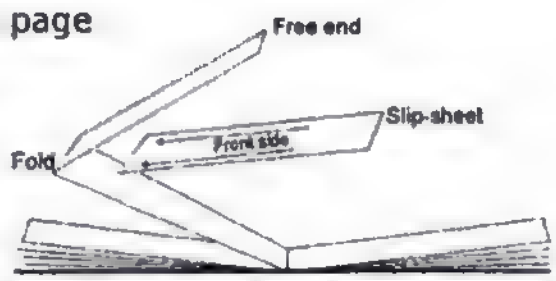
1. Follow instructions on the other side

Folded edge of the page



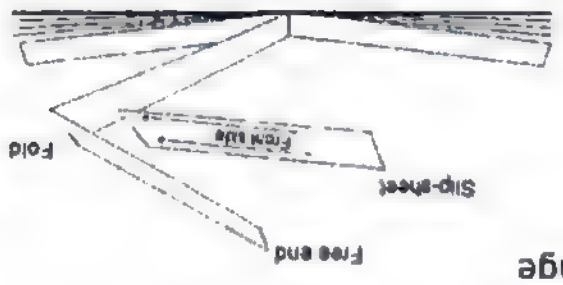
Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Vince Carnett, Test Technician

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FANTASTIC FAX

The first implementation of a PostScript fax/modem for a laser printer, NEC's $599 internal plain-paper fax solution supports both the sending and receiving of standard 200-dpi Group 3 facsimiles. Users can designate specific jobs to be faxed or printed with a software command (the software comes in DOS, Microsoft Windows, and Macintosh versions). The printing and faxing functions can operate simultaneously.

The PostScript capability comes into play when one fax-capable Silentwriter 95 is dealing with another (or any other PostScript fax-capable printer): The transmission will consist of PostScript language commands when possible, enabling the receiving printer to reconstruct the document at a full 300 dpi.

The Silentwriter won't produce camera-ready copy, but its edge-smoothing algorithms improve on typical 300-dpi output.

In testing, the printer kept up with its peers and sometimes edged just slightly ahead. It handled text at 6 pages per minute and graphics at 1.9 graphics pages per minute in PCL mode on our tests; in PostScript mode, it printed text at 5.8 ppm and graphics at 0.4 gppm.

The NEC Silentwriter Model 95 represents a tremendous value, whether or not the idea of its PostScript fax option sets your check-writing hand to twitching. If you're shopping for a capable PostScript printer at a bargain price, add this one to your list.

NEC Technologies Inc., *1414 Massachusetts Ave., Boxborough, MA 01719; 800-388-8888, 508-264-8000; fax, 508-366-6476.*

EDITORS' CHOICE ▶ NEC Silentwriter Model 95 *List price: $1,749; 2MB RAM upgrade, $399; 3MB RAM upgrade, $798; 250-sheet legal-size paper cassette, $79; second 250-sheet multipurpose paper cassette feed (letter-, A4-, legal-, executive-size), $349; 50-sheet faceup output tray, $39; microfine toner cartridge, $249; internal PostScript fax/modem, $599; Ethernet interface, $649. Dimensions (HWD): 10.3 x 18.6 x 15 inches. Weight: 37.5 pounds. Emulations: Adobe PostScript Level II, HP PCL 5. Circle 489 on reader service card*

NewGen Systems Corp.

NewGen TurboPS/300p
NewGen TurboPS/400p
NewGen TurboPS/630En
NewGen TurboPS/660
NewGen TurboPS/840e
NewGen TurboPS/880

BY GREG PASTRICK

In 1990, NewGen Systems introduced its first PostScript-compatible laser printer: the NewGen TurboPS/480 ($7,495). Since then, the company's expansion has been prolific. Today, its line of 4- and 8-page-per-minute Personal, Premier Pro, and Task Pro series lasers includes seven desktop systems. (See the shared lasers section for a review of its high-end NewGen TurboPS/1200T.) Unfortunately, all of the lasers in the company's line share a basic HP PCL incompatibility.

Two 4-ppm printers hold up the low end of the line: the compact TurboPS/300p ($1,995) and the TurboPS/400p ($2,595). In the middle are the HP LaserJet–size 8-ppm printers (the 600 series); we tested the TurboPS/630En ($3,595) and the TurboPS/660 ($3,495). (We did not test the $2,995 TurboPS/630, which is the same as the TurboPS/630En but without the Ethernet option.) The last two 8-ppm printers add 800-dpi resolution: the TurboPS/840e ($3,995) and the TurboPS/880 ($4,795).

Across the line, the NewGen lasers showed a critical PCL 4 command language incompatibility in handling graphics on both our Graphics Speed test and PCL Torture Test. In that mode, none of these printers could print our logo without banding or generate the Graphics Speed test file without unusual artifacts—testimony to the laser line's poor handling of PCL emulation. In addition, the NewGen lasers are unable to accurately emulate the PCL font commands for Helvetica. As a class, the NewGen printers performed poorly on all our Windows applications tests in PCL mode—a few were unable even to perform some of these tests at all. NewGen's technical people recognize some PCL incompatibility and are working on it, but they emphasize that these lasers are meant for the PostScript market.

The company's PostScript Level 1 interpreter supports Type I and Type III fonts; each printer comes with the same 35 resident PostScript fonts. The entire TurboPS line of lasers comes standard with installed AppleTalk interfaces in addition to standard parallel and serial port hookups. All six printers switch automatically among ports and emulations, though you can limit the printers to a single emulation through the control panel.

NewGen TurboPS/630En, NewGen TurboPS/300p, NewGen TurboPS/660, NewGen TurboPS/840e, NewGen TurboPS/400p, NewGen TurboPS/880

The 4-ppm lasers are both based on the Canon LX engine; the 8-ppm models all use the Canon SX engine. All six units use a Weitek XL-8220 RISC processor, running at 16 MHz for the 4-ppm printers and 25 MHz for the others.

Although each model comes with different features, most accept upgrades. The 4-ppm lasers support up to 16MB of RAM; the 8-ppm printers hold up to 32MB. You can also add a $499 Ethernet card to the TurboPS/660 or the TurboPS/840e; a SCSI interface card (for hard disks only) for the TurboPS/300p or the TurboPS/400p costs $149.

With two exceptions, all come with either Level 1 or Level 2 of NewGen's Image Enhancement Technology (IET). IET Level 1 is designed to improve line and curve smoothing; Level 2 also enhances halftones. With 300-dpi output, there is little noticeable difference among the printers, though the higher resolutions gain more from the IET. You can add a $499 IET Level 1 option to the TurboPS/300p or the TurboPS/630En.

The 4-ppm models each come with a 70-sheet multipurpose paper tray. The other four units come with a 200-sheet letter-size tray.

PERSONAL SERIES

Apart from the $600 price margin, the main difference between the two 4-ppm models—the TurboPS/300p and TurboPS/400p—is that the TurboPS/400p comes with an additional 1MB of memory (4MB total), higher resolution (400 dpi versus 300 dpi), and built-in IET Level 1. Street prices for the TurboPS/300p run near $1,400; the TurboPS/400p can be found for $2,000.

At standard resolution, the TurboPS/300p managed 3.8 ppm on our PCL-mode tests; the TurboPS/400p managed 3.9 ppm. Their PCL 4 graphics scores of 0.7 graphics pages per minute couldn't match those of the Brother HL-4Ve or the HP LaserJet IIP Plus. The NewGen duo's scores were about the same on our PostScript tests, but in that emulation, 0.7 gppm is a much more acceptable score.

TASK PRO SERIES

The $3,595 TurboPS/630En—with a street price closer to $3,100—is a network-ready 600- by 300-dpi laser with 6MB of RAM and an installed Ethernet adapter based on a 32-bit AMD controller. It supports EtherTalk and TCP/IP interfaces but had no IPX support at review time. Flash ROM updates for IPX should be available by press time.

Priced at $3,495, the 600- by 600-dpi TurboPS/660 is equipped with NewGen's Level 2 IET and 6MB of RAM but no Ethernet card. The street price for the TurboPS/660 should be under $3,000.

PCL 4 text speed was 7.1 ppm for the TurboPS/660 and 7.3 ppm for the TurboPS/630En; PostScript text speed was 7.5 ppm and 7.6 ppm, respectively. PostScript 300-dpi graphics speeds were better than average: 0.9 gppm for both. (Their slower score of 0.4 gppm on our informal 600-dpi tests is in line with what you'd expect at the higher resolution.) But graphics times were plodding, at 1.2 gppm for both.

Street prices as low as $1,400 make the Okidata OL810 one of the most affordable 8-ppm printers reviewed here.

PREMIER PRO SERIES

NewGen's 8-ppm TurboPS/840e ($3,995) has 800- by 400-dpi resolution, 6MB of RAM, and the company's lower-level smoothing technology. The 800- by 800-dpi TurboPS/880 ($4,795) comes network-ready with the same Ethernet adapter used by the TurboPS/630En but ships with 12MB of RAM and the company's IET Level 2. Street prices run as low as $3,500 for the TurboPS/840e and $4,100 for the TurboPS/880.

Like the Task Pro series printers, the Premier Pros were just a little slow on PCL 4 Text and Graphics Speed tests, despite the double-buffering scheme that starts creating a page in memory while the first prints. They each turned out 7.2 ppm in our Text Speed test; the TurboPS/840e and the TurboPS/880 handled 1.3 and 1.1 gppm, respectively. PostScript text speeds at 300-dpi were decidedly better: 7.6 ppm for the TurboPS/840e and 7.3 ppm for the TurboPS/880. PostScript graphics speeds were laudable at 0.9 gppm for the TurboPS/840e and 1.1 gppm for the TurboPS/880.

The NewGen printers have an attractive list of features and built-in capabilities. Under PostScript, the output is of sound quality. But PCL incompatibilities deny NewGen's claimed support for this all-too-common emulation.

NewGen Systems Corp., *17580 Newhope St., Fountain Valley, CA 92708; 800-756-0556; fax, 714-641-2800.*

NewGen TurboPS/300p *List price: $1,995. 1MB RAM upgrade, $89; 2MB RAM upgrade, $169; 4MB RAM up grade, $329; 250-sheet cassette (letter-, A4-, legal-, or executive-size), $69 each; envelope cassette, $89; lower-tray assembly, $195; toner cartridge, $99; SCSI interface, $149; IET module, $399. Dimensions (HWD): 7.5 x 16 x 13.5 inches. Weight: 26 pounds. Emulations: HP PCL 4, HPGL, NewGen PostScript interpreter.*

NewGen TurboPS/400p *List price: $2,595; no IET module; other options the same as for the TurboPS/300p. Dimensions (HWD): 7.5 x 16 x 13.5 inches. Weight: 26 pounds. Emulations: HP PCL 4, HPGL, NewGen PostScript interpreter.*

NewGen TurboPS/630En *List price: $3,595; 1MB RAM upgrade, $89; 2MB RAM upgrade, $169; 4MB RAM upgrade, $329; 8MB RAM upgrade, $649. 200-sheet cassette (A4-, legal-, or executive-size), $75 each; envelope cassette, $89; 200-sheet multipurpose cassette, $75; toner cartridge, $119; IET module, $749. Dimensions (HWD): 9.1 x 18 x 25.5 inches. Weight: 48 pounds. Emulations: HP PCL 4, HPGL, NewGen PostScript interpreter.*

NewGen TurboPS/660 *List price: $3,495; Ethernet interface, $499; no IET module; other options the same as for the TurboPS/630en. Dimensions (HWD): 9.1 x 18 x 25.5 inches. Weight: 48 pounds. Emulations: HP PCL 4, HPGL, NewGen PostScript interpreter.*

NewGen TurboPS/840e *List price: $3,995; 1MB RAM upgrade, $89; 2MB RAM upgrade, $169; 4MB RAM upgrade, $329; 8MB RAM upgrade, $649; 200-sheet cassette (letter-, A4-, legal-, or executive-size), $75 each; envelope cassette, $89; 200-sheet multipurpose cassette, $75; toner cartridge, $119; Ethernet interface, $499. Dimensions (HWD): 9.1 x 18 x 25.5 inches. Weight: 48 pounds. Emulations: HP PCL 4,*

HPGL, NewGen PostScript interpreter.

NewGen TurboPS/880 *List price: $4,795; no Ethernet interface; other options the same as for the TurboPS/630En. Dimensions (HWD): 9.1 x 18 x 25.5 inches. Weight: 48 pounds. Emulations: HP PCL 4, HPGL, NewGen PostScript interpreter.*
Circle 490 on reader service card

Okidata

Okidata OL810 LED Page Printer

BY GREG PASTRICK

Okidata's Okidata OL810 LED Page Printer ($1,699) is a fast, stripped-down HP LaserJet Series III–compatible version of the company's HP PCL 4– and Adobe PostScript–compatible Okidata OL830 ($1,999; an Editors' Choice winner in last year's printer issue). The paper path on this compact PCL 5 laser is short, which helps deliver fast page printing. Street prices as low as $1,400 make the OL810 one of the most affordable 8-page-per-minute printers reviewed here.

The OL810 is a snappy little 300-dpi printer built on a triple-scan line LED printhead and 12-MHz Motorola 68000 processor. The OL810 comes with 1MB of proprietary RAM and supports up to 5MB. PostScript isn't included in the standard price, but an optional emulation should be available by the time you read this.

In its PCL 5 mode, the OL810 matched its 8-ppm rating on straight text file output—the quickest among the 8-ppm printers. The unit printed our Graphics Speed test file at 2.9 graphics pages per minute, tying for fifth place among the group. The OL810 did not pass our PCL Torture Test in PCL 5 mode, although it did in PCL 4.

This model uses its OKI Smoothing technology to enhance its 300-dpi output. This smoothing technology does not completely eliminate jaggies, but it does a very acceptable job. OKI Smoothing also improves halftone output quality. Using this technology, resolution approximates 300- by 1,200-dpi output, according to Okidata.

The OL810 comes with 21 resident bitmapped fonts and 13 scalable fonts. Extra font cards cost $499 per task-oriented grouping (special documents, presentations, or WP scalable fonts).

The OL810 maintains a low physical profile. At 6 inches high, the base unit is a lot easier to handle than lasers modeled on the dimensions of the HP LaserJet box. The standard paper tray holds 200 sheets of letter-size paper. To fit an extra tray, you'll have to mount its 4.25-inch second-story tray unit ($329) to the bottom of the printer.

The OL810 comes with a healthy list of installed fonts and available font cards. For its performance and price, Okidata's OL810 is a good starting point if you're looking for a personal laser.

Okidata OL810 LED Page Printer

Okidata, *532 Fellowship Rd., Mount Laurel, NJ 08504; 800-654-3282, 609-235-2600; fax, 609-778-4184.*

Okidata OL810 LED Page Printer *List price: $1,699. 1MB RAM upgrade, $239; 2MB RAM upgrade, $399; additional font cartridges, $499 each; second paper tray mechanism, $329; second 200-sheet letter cassette, $89; 200-sheet cassette (legal-, executive-, or A4-size), $89 each; envelope cassette, $89; 200-sheet multipurpose cassette, $109; drum, $289; toner cartridge, $33; serial adapter, $99. Dimensions (HWD): 6 x 17.25 x 17.75 inches. Weight: 31 pounds. Emulations: HP PCL 5, IBM Proprinter.*
Circle 491 on reader service card

Panasonic Communications & Systems Co.

Panasonic KX-P4410
Panasonic KX-P4430

BY GREG PASTRICK

Filling a gap at the low end of its laser printer line, Panasonic released two 300-dot-per-inch, 5-page-per-minute members of its Laser Partner series of personal and small-office printers. Based on the company's own 4400-series engine, the $1,095 KX-P4410 and $1,495 KX-P4430 are designed around a set of basic features and options that ensure compatibility with the HP LaserJet Series IIP and III, respectively.

This pair's decent performance and few enhanced functions will attract bargain hunters, though it would be hard to justify paying more for them. Street prices on the HP PCL 4–compatible 4410 (with its base 512K of RAM) are under $1,000; the 4430, which emulates PCL 5, has street prices close to $1,300 for the base model with 1MB of RAM. Both come standard with a 200-sheet multipurpose paper tray. Beyond their respective emulation modes (and the eight scalable fonts PCL 5 gives the 4430), base memory amounts, and the 4430's serial port, these lasers have few differences.

For both, you'll need to buy extra RAM if you plan on doing any sort of graphics or heavily formatted text printing. This involves plugging in a $175 RAM motherboard (which comes with 1MB) and then shelling out $150 for each proprietary additional megabyte. Both models can handle up to 4MB beyond their base configurations. Neither laser was able to run our PCL Torture Tests or Graphics Speed test until we brought the printers up to 2MB of RAM.

On our Text Speed test in its respective PCL modes, the 4410 scored 4.5 ppm and the 4430 delivered 4.7 ppm. Graphics speeds were a little slow, even compared with some 4-ppm models: 1.4 gppm for each. And even with the 4430's built-in SatinPrint Smoothing technology, print quality revealed too many jaggies to be considered anything more than ordinary.

For our review, Microsoft Windows 3.1 drivers for both printers were unavailable, but they should be by the time you read this. As an alternative, drivers for the 11-ppm KX-P4450i or HP LaserJet Series IIP (4410) and III (4430) work appropriately.

If there's any particular advantage built into this low end of the 4400 line, it's found in the 14 landscape and 14 portrait bitmap fonts in each laser. Panasonic also offers six font cards of its own, which cost $145 each.

All things considered, the 4410 and 4430 are two ordinary printers with performance and features appropriate to

undemanding print tasks. You can expect no more from low-end lasers such as these.

Panasonic Communications & Systems Co., *Two Panasonic Way, Secaucus, NJ 07094; 800-742-8086; fax, 201-392-4500.*

Panasonic KX-P4410, Panasonic KX-P4430

Panasonic KX-P4410 *List price: $1,095; 1MB RAM upgrade, $150; 1MB RAM motherboard, $175; additional font cards, $145 each; 200-sheet second bin letter cassette, $199; drum, $139; developer, $169; toner cartridge, $49. Dimensions (HWD): 9.5 x 14.5 x 15.5 inches. Weight: 31 pounds. Emulations: HP PCL 4.*

Panasonic KX-P4430 *List price: $1,495; same options as for the Panasonic KX-P4410. Dimensions (HWD): 9.5 x 14.5 x 15.5 inches. Weight: 31 pounds. Emulations: HP PCL 5.*

Circle 498 on reader service card

Samsung Electronics America Inc., Information Systems Division

Samsung Finalé 8000

BY MITT JONES

If you judge it by its first laser offering, the Information Systems Division of Samsung Electronics seems to have entered the laser market to stay. Based on Samsung's own F8000 engine and boasting a 16-MHz RISC processor—the Intel i960 KA—the $1,995 Samsung Finalé 8000 leads the field of desktop lasers in PCL graphics speed and holds its own on most other chores.

This 8-page-per-minute laser printer, which should sell for about $1,520 on the street, comes with dual 250-sheet letter-size paper cassettes; 2MB of RAM; and Epson FX, HP PCL 5, IBM Proprinter, and PostScript (via Samsung's PDL Level 1 clone) emulations.

The printer comes with 35 PostScript font outlines and the 14 bitmapped and 8 scalable fonts of the HP LaserJet III. Two slots accommodate HP-compatible font cartridges.

During testing, the Finalé 8000 scored a blazing 3.6 graphics pages per minute with PCL 5 graphics. The other scores were also admirable, though less impressive: 7.5 ppm on PCL Text Speed, 7.4 ppm on PostScript Text Speed, and 0.7 gppm on PostScript Graphics Speed.

The printer had no problem producing 300-dot-per-inch laser-quality output, though characters suffer from the jagged edges characteristic of unadorned 300-dpi output. Samsung only offers character edge and halftone enhancement as part of its $995 ImageResolution Kit, scheduled for November availability. The upgrade will also add true 600-dpi capability, PostScript Level 2 compatibility, extra-fine toner, and a 4MB SIMM.

Outside of Windows, the Finalé 8000's emulation switching requires that users insert a printer setup string in their applications. Unfortunately, this is also one of a few areas that the manual treats poorly. A Samsung spokesperson reported that users should call Samsung technical support for guidance on modifying DOS application drivers. The new Windows GDI driver, which should be available by the time you read this, will provide support for automatic emulation switching under Windows. The GDI driver should also speed printing even further by allowing TrueType fonts to be passed to the printer's internal TrueType rasterizer.

Samsung Finalé 8000

The Finalé 8000 supports automatic interface switching between its standard parallel and serial ports, as well as the forthcoming optional interfaces: Ethernet, Token-Ring (both available through third-party vendors), and AppleTalk ($129). Other options include a soon-to-be-available $795 external fax device. You can upgrade the 2MB of RAM to a total of 18MB.

The Samsung Finalé 8000 offers a compelling mix of PCL 5 graphics speed, solid emulations, and low price. Its two-year warranty should help ease any doubts about the soundness of the untried engine. If you can live with unadorned 300-dpi output—most of us can—this printer may well offer just the right performance and features.

Samsung Electronics America Inc., Information Systems Division, *105 Challenger Rd., Ridgefield Park, NJ 07660; 800-446-0262, 201-229-4000; fax, 201-229-4069.*

Samsung Finalé 8000 *List price: $1,995; 2MB RAM upgrade, $265; 4MB RAM upgrade, $395; 250-sheet legal- or A4-size paper cassette, $69 each; developer, $249; toner cartridge, $79; AppleTalk Start-Up Kit, $129; ImageResolution Kit, $995; external fax option, $795; drum, $159. Dimensions (HWD): 9.8 x 18.25 x 27.1 inches. Weight: 50.7 pounds. Emulations: Epson FX, HP PCL 5, IBM Proprinter, Samsung PDL PostScript interpreter.*

Circle 499 on reader service card

Texas Instruments Inc.

TI microLaser Turbo

BY EDWARD MENDELSON

Texas Instruments offers two basic laser printer models that users can upgrade as the printers evolve. The first is the small-footprint microLaser Turbo: You can buy this 9-page-per-minute printer with Adobe Level 2 PostScript and LaserJet II emulations off the shelf for $1,749, or you can upgrade to this model from any earlier microLaser. The second model, the 16-ppm microLaser XL Turbo, is reviewed with the shared printers.

The microLaser Turbo is a compact workhorse that lacks refinements such as resolution enhancement. But for a street

Claude Monet, *Cliff Walk at Pourville, 1882.*

The image is priceless.

Fortunately, the printer isn't.

The clear superiority of solid ink technology is becoming legend.

Vibrant, precision color is finally here, and with JOLT it's also finally affordable.

Perhaps more surprising is that the image above is even better than this ad can show you, because this magazine uses a liquid ink which bleeds when it hits the paper. Solid ink holds its shape for noticeably better resolution.

Not only did Dataproducts pioneer the development of solid ink technology, our JOLT is also $3000 less than the only other color solid ink Adobe® PostScript® Level 2 printer on the market.

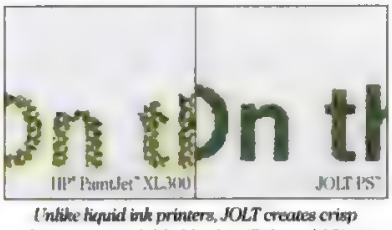
Even more impressive is JOLT's flexibility. Because of the non-dispersing

Liquid ink bleeds, often causing unintended and inaccurate color. Solid ink does not.

nature of solid ink, it can not only print on plain paper, but on virtually any paper surface, giving you immense latitude when creating documents, presentations, publications and color comps.

And because of its solid ink technology, JOLT prints more readable text, even at extremely small point sizes.

Finally, JOLT is also more economical since it doesn't require any kind of special paper.



Unlike liquid ink printers, JOLT creates crisp characters in solid, bold color. (Enlarged 250%)

Imagine. Now you can produce 16.7 million different hues with the precision and vibrancy of solid ink, all at a remarkably low price.

So see your Dataproducts dealer today for a demonstration or call 1-800-334-3174 for more information.

Then stop by and check out JOLT, because when it comes to color printing, seeing is believing.

Dataproducts.

The high performance printer people™

Group Hitachi Koki

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CIRCLE 227 ON READER SERVICE CARD

Speeding Up Windows Printing

by Edward Mendelson

Your HP LaserJet produces fast output from Windows but not as quickly as your computer can. Instead of relying on a printer's slower processor, LaserMaster's WinJet/300 ($495) and WinJet/800 ($795), and Myriad Enterprises' PrintSprint ($399) use the speed of your PC's CPU to process data. If you have a fast computer, you'll find that graphics and text pop out of your printer at speeds that you never imagined possible. Upgrade to a faster PC, and the boards get faster too.

All three boards use the video input/output port found on the back panel of the LaserJet II, IID, III, and IIID. But don't even think of using them with the LaserJet IIP or IIIP, or with any non-HP printer (except for the Canon LBP-4, which works only with the two WinJets). The WinJet/800 adds both speed and 800-dpi resolution. The WinJet/300 and the PrintSprint add speed but print only at 300 dpi. Myriad reports it is working on a version that will handle 600 dpi.

You install the products by plugging a 16-bit card into your PC and a small circuit board into the printer's video port and connecting them via the supplied cable. You then load a printer driver and (for the WinJets) other software into Windows.

Even with its higher price tag, the WinJet/800 is an amazing bargain. It turns your printer into the equivalent of the $1,595 4-ppm LaserMaster WinPrinter 800 (see the review in this section) but with important differences. It lets you use the HP LaserJet in its native PCL mode exactly as you always do. And of course, the WinJet's performance can take advantage of fast printer engines. The WinJet/300 works the same way.

The WinJets print in one of two modes. The fastest mode prints directly from Windows' own GDI (Graphics Device Interface), without translating the output into another printer language. In GDI direct-driver mode, the WinJet/800 prints only 300 dpi.

The slower mode is PostScript; with the WinJet/800, you get your choice of 300 dpi or 800 dpi. The PostScript mode is based on LaserMaster's enhanced version of Microsoft's TrueImage, a PostScript interpreter that can use TrueType fonts without requiring that they first be translated into PostScript fonts. Fifty TrueType fonts come in the box.

All PostScript and TrueType fonts are treated as if they were built into the printer. You won't worry about whether a font needs to be downloaded.

The WinJets use a Windows DOS box to run the PostScript interpreter. When you load Windows, you'll notice a slight delay while the interpreter gets started. After that, performance on an 8-ppm LaserJet III connected to a 486/33 was fast, with almost no delay in foreground applications.

RUNS FAST, LESS FILLING

PrintSprint is a simpler product that needs only 4MB of RAM (compared with 8MB for the WinJets) and uses only a simple direct-from-Windows printer driver instead of the WinJet's complex software.

On informal tests, PrintSprint prints about 95 percent as fast as the WinJet/800's direct driver but produced far cruder results in gray-scale printing. If you need speed, simplicity, and the lowest price, it may be your first choice. But both WinJets offer greater flexibility, and the WinJet/800 adds high resolution to the bargain. □

LaserMaster Corp., *6900 Shady Oak Rd., Eden Prairie, MN 55344; 800-365-4646, 612-943-8286; fax, 612-944-9529.*

WinJet/300, WinJet/800 *List price: WinJet/300, $495; WinJet/800, $795.*

Myriad Enterprises Inc., *3149 Bonn Dr., Laguna Beach, CA 92651; 800-593-8165, 714-494-8165; fax, 714-497-9398.*

PrintSprint *List Price: $399.*

Circle 540 on reader service card

price of about $1,250, you get impressive flexibility and speed that is enhanced by a 16-MHz Weitek 8220 RISC processor.

The microLaser Turbo output HP PCL 4 text at 8.3 ppm. Its PCL graphics score was slower than you would expect—1.8 gppm. PostScript scores were solid—8.4 ppm and 0.8 gppm. The 300-dot-per-inch Sharp JX-9500 engine provides clear, dark output.

With a 13.4- by 14.2-inch (WD) footprint, the microLaser Turbo deserves the adjective "micro." The printer comes with 2.5MB of RAM, divided between 2MB for PostScript and 512K for the LaserJet emulation. You can add 4MB to each emulation using TI-style SIMMs (widely available from third parties). Unlike the HP and other printers with multiple modes, the microLaser can't share memory between its two emulations.

The printer comes with a parallel port, and you can add a $249 Comm Plus board that provides AppleTalk, RS-232, and RS-422 connections, plus a SCSI port to hook up an external hard disk for storing PostScript soft fonts. Or you can use the Comm Plus card's slot for third-party Ethernet cards from Printer Systems (call TI for more information). The printer allows for simultaneously active ports and will switch interfaces automatically.

Two slots let you install emulation or font cards. Plug-in cards for Epson, Diablo, or Proprinter emulations cost $135 each; the printer automatically switches among emulations. You can add to the 35 PostScript fonts by buying TI's HP-compatible font cards ($135 to $399 apiece). You can buy PostScript-compatible font cards from Sonnet Technologies (Irvine, California; 714-261-2800).

A 250-sheet input tray holds standard sheets. A second 250-sheet drawer costs $275.

An upgrade kit that converts the microLaser (reviewed in our 1990 annual printer issue) to the current model consists of a new controller and costs $1,250. A $250 firmware change (performed at depot) brings the older microLaser's 6-

ppm engine up to 9-ppm Turbo speed.

The microLaser Turbo stands out for quick, compatible performance at a good price. If you want an inexpensive printer that will be able to grow as technology grows, this may be the one to choose.

Texas Instruments Inc., *P.O. Box 202230, Austin, TX 78720-2230; 800-527-3500, 817-771-5856; fax, 817-774-6751.*

TI microLaser Turbo *List price: $1,749; 1MB RAM upgrade, $109; 4MB RAM upgrade, $399; Epson, Diablo, or Proprinter emulations, $135 each; additional font cartridges, $135 to $399; 250-sheet paper cassette (letter-, legal-, executive-, A-, B5-size), $55; 250-sheet second paper drawer (letter-, A4-, executive-size), $275; envelope feeder, $275; drum, $110; developer, $90; toner cartridge, $42; Comm Plus board, $249; AppleTalk interface, $50; serial adapter, $35. Dimensions (HWD): 10.9 x 13.4 x 14.2 inches. Weight: 35 pounds. Emulations: Adobe PostScript Level 2, HP PCL 4.*
Circle 500 on reader service card

Toshiba America Information Systems Inc., Electronic Imaging Division

Toshiba PageLaser GX200

BY MITT JONES

The $1,799 Toshiba PageLaser GX200, from the Electronic Imaging Division of Toshiba America Information Systems, won't turn the industry on its ear, but this unit's combination of decent performance, solid HP PCL 5 emulation, and fairly competitive pricing may earn it a closer look.

Based on the 8-page-per-minute LB-1323 engine from Tokyo Electronics Corp. (TEC), the 300-dot-per-inch GX200 comes standard with 1MB of RAM, a 250-sheet multipurpose paper cassette, a 250-sheet output tray, and three emulations: Epson FX, IBM Proprinter, and PCL 5. Two cartridge slots accept HP-compatible font cartridges, and resident fonts comprise the 14 bitmapped and 8 scalable fonts of the HP LaserJet III. You can upgrade to 5MB of proprietary RAM (1MB for $249, 2MB for $499).

Oddly enough for what is meant as a small workgroup unit, the GX200 offers neither automatic emulation switching nor automatic interface switching. To switch between the standard serial and parallel interfaces, you'll have to specify the setting using the control panel. But the unit does offer options for Ethernet ($699) and Token-Ring ($899).

The GX200 tested at an impressive rate of 3.0 graphics pages per minute with PCL 5 graphics, thanks largely to its 16-MHz Motorola 68000 processor. PCL 5 text results were more average: 7.6 ppm.

Toshiba offers an optional PostScript emulation (via the Toshiba PDL Level 1 interpreter), along with the full collection of Type 1 font outlines, via a $699 cartridge. As is often the case, however, you're probably better off with a printer that includes the emulation as standard fare if PostScript is what you're after: The GX200's PostScript speed scores were a lackluster 6.6 ppm and 0.4 gppm.

SMOOTH PRINTING

When it comes to print quality, the GX200 excels in one regard: the print enhancement technique smoothes jagged character edges to an impressive degree, though you still won't get the crisp edges you could expect from a 600-dpi printer.

The printer occupies a relatively small footprint of 15.5 by 15.9 (WD) inches, but the standard feed tray protrudes well away from the front of the printer, bringing the total depth to 25.7 inches. A $199 300-sheet multipurpose second cassette fits neatly underneath the machine.

The Toshiba PageLaser GX200 falls short of compelling, but it combines competence and speed into an attractive, reasonably priced offering.

Toshiba America Information Systems Inc., Electronic Imaging Division, *9740 Irvine Blvd., Irvine, CA 92718; 800-468-6744, 714-583-3000; fax, 714-583-3645, 714-587-6810.*

Toshiba PageLaser GX200 *List price: $1,799; 1MB RAM upgrade, $249; 2MB RAM upgrade, $499; Toshiba PDL PostScript emulation, $699; 250-sheet legal- or A4-size paper cassette, $69 each; 300-sheet multipurpose second paper cassette feed (letter-, A4-, legal-size), $199; 50-sheet faceup output tray, $39; drum, $149; toner cartridges (two-pack), $49; Ethernet interface, $699; Token-Ring interface, $899. Dimensions (HWD): 8.6 x 15.5 x 25.7 inches. Weight: 31 pounds. Emulations: Epson FX, HP PCL 5, IBM ProPrinter.*
Circle 501 on reader service card

Xante Corp.

Xante Accel-a-Writer 8000

BY ROBERT S. ANTHONY

Xante Corp. made a name for itself by making other people's printers look good: It has manufactured Accel-a-Writer upgrade printer controllers for HP and Apple laser printers since 1989. Now it has finally produced a printer of its own: the $3,295 Xante Accel-a-Writer 8000. With Xante's homegrown 600-by-600-dot-per-inch printing technology, the Accel-a-Writer produces high-quality output at solid speeds.

Inside the case, you'll find a 16-MHz AMD 29000 RISC processor and an 8-page-per-minute Canon SX engine. The base configuration includes 8MB of RAM (upgradable to 16MB for $600), as well as serial, parallel, SCSI, and AppleTalk ports. The unit supports simultaneously active ports, but it won't switch interfaces automatically (though the company says this feature will be available by press time).

You get both HP PCL 4 and Phoenix Level 1 PostScript emulations. Apart from Courier and Line Printer fonts, and the 35 resident Bitstream Type 1 fonts, you can download and permanently store 15 fonts on a built-in 512K virtual disk

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CIRCLE 278 ON READER SERVICE CARD

Xante Accel-a-Writer 8000

(30 if you upgrade to 1MB) or more if you connect a hard disk to the SCSI port.

The Accel-a-Writer delivers true 600-by-600-dpi resolution (PostScript mode only). Xante claims that its technology for enhancing halftones provides resolutions equivalent to 850 by 850 dpi with 197 shades of gray. When tested with Windows 3.1's 600-dpi IBM 4029 PS39 printer driver, it produced clean, crisp graphics with excellent shadow detail.

The Accel-a-Writer performed solidly for its class. In PCL 4 mode, it produced 7.7 ppm and 2.1 gppm. On PostScript tests, it scored 7.5 ppm and 0.9 gppm. The Accel-a-Writer suffered an expected drop in speed—to 0.3 gppm—on informal 600-dpi graphics tests.

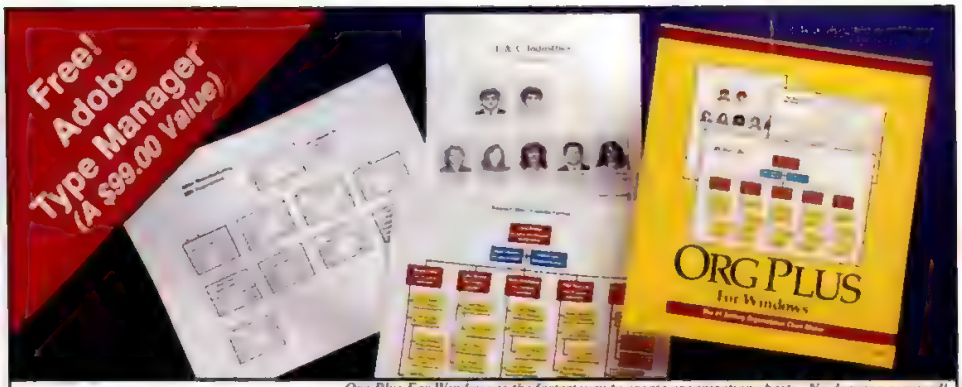
Paper handling was straightforward. The unit includes a 100-sheet letter-size input tray and a 100-sheet output tray.

The front-panel controls weren't hard to understand, which was a relief, since the manual was sometimes misleading. At the control panel, you can adjust emulations, resolution, and the PostScript dual-page processing option, which allows a second page to be created in memory while the first is printing.

With its 600-dpi resolution and fine print quality, the Accel-a-Writer is a good choice. Xante has learned something about doing it right the first time. □

Xante Corp., *2559 Emogene St., Mobile, AL 36606; 800-926-8839, 205-476-8189; fax, 205-476-9421.*

Xante Accel-a-Writer 8000 *List price: $3,295; 4MB RAM upgrade, $400; 8MB RAM upgrade $800; second 200-sheet letter-size paper cassette, $69; 200-sheet legal- or A4-size paper cassette, $69 each; toner cartridge, $99. Dimensions (HWD): 9 x 17.8 x 25.1 inches. Weight: 41 pounds. Emulations: HP PCL 4, Phoenix PostScript interpreter.*
Circle 502 on reader service card



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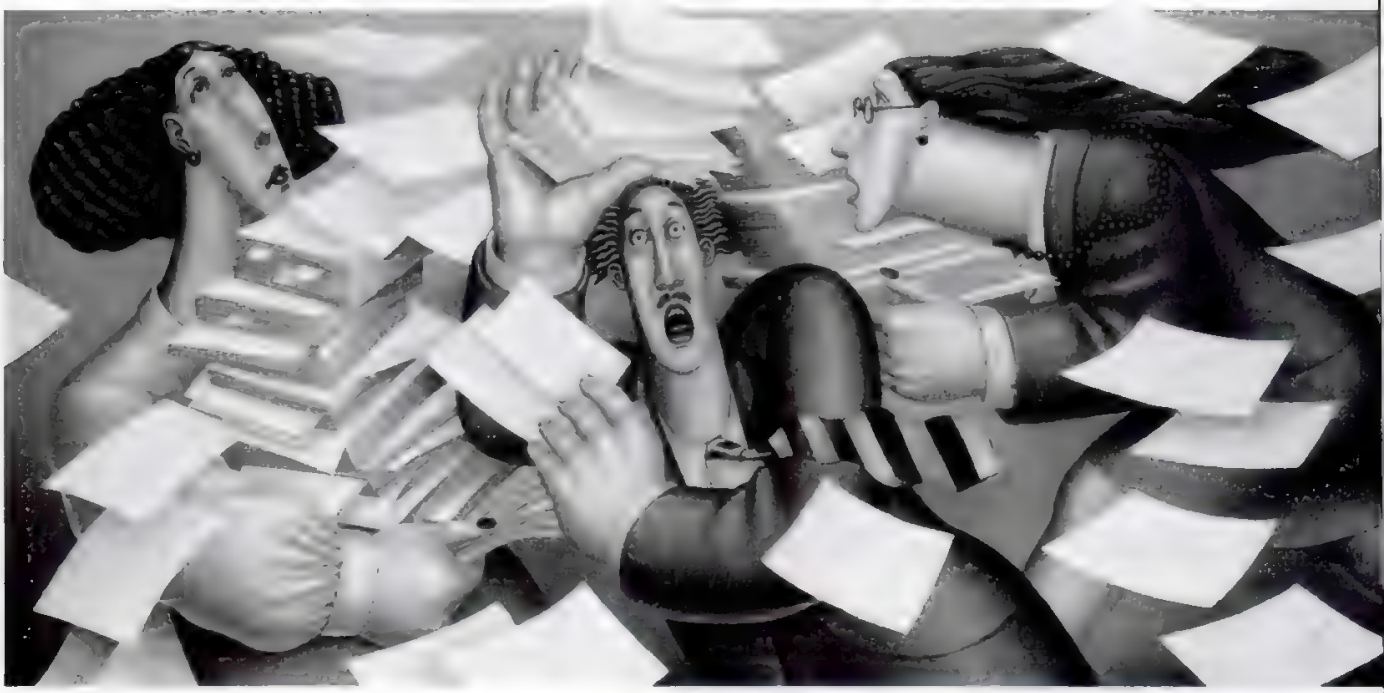

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SHARED LASERS

Out on the LAN

They're fast, feature-rich, and coming to a network near you. With high-capacity engines, vast paper handling options, and ledger-size printing, these 16 shared lasers will satisfy most LAN printing needs.

by Alfred Poor

It's 5:50 P.M. and you've just finished the final draft of a 50-page report. Now you have to print it in time to make copies before the express courier shows up for the day's last pickup. If you're lucky enough to have a 4-ppm personal laser on your desk, it will take at least 12 minutes to print—assuming it prints at full engine speed. But if you have access to a shared laser printer—say one with an engine speed of 17 ppm—your report could be sitting in the output tray in under 3 minutes.

The allure of high-speed output is just one reason why shared laser printers are becoming so attractive to businesses. That you can buy one 17-ppm laser to share among a workgroup of 15 or 20 users for about the price of a handful of 6-ppm personal page printers further enhances their appeal.

In fact, shared printers show the fastest growth rates of any segment of the laser printer market, based on units sold. BIS Strategic Decisions forecasts a compound annual decline of 11.2 percent for printers in the 7- to 11-ppm engine speed range over the next five years (based on units sold), while it expects annual unit sales of 12- to 19-ppm printers to grow by 34.4 percent. Printers with 20- to 40-ppm engines are close behind, with a predicted 25.8 percent growth rate. In contrast, sales of personal lasers with engines rated at 6 ppm or less are predicted to grow only at a 14.2 percent annual rate.

Manufacturers have responded to the demand by expanding their product lines to include more shared printers. Here we review 16 printers with engines rated at 12 ppm or greater—more than ever before. Fast engines help make these printers appropriate for use on mid- to large-size networks.

This year also saw an important new presence in network printing: Compaq Computer, whose fast Compaq PageMarq 15 and Compaq PageMarq 20 lasers set new standards for shared printer design.

Continuous-form laser printers also make their first appearance in our 1992 printer issue. The four continuous-form printers we review (from Advanced Matrix Technology, Output Technology, Printronix, and Synergystex International) use pin-feed rather than cut-sheet paper. These 16-ppm

Photograph by Scott Wippermann

printers are best for applications where careful print registration is required: labels, invoices, checks, and other forms, for example.

In that respect, their competitors are not so much other fast page printers as they are dot matrix devices, particularly line printer emulators. In fact, the Printronix L1016 Continuous Form Laser Printer includes only impact emulations in its standard configuration; the PhoenixPage PostScript interpreter we tested is an option that you load from the printer's two floppy disk drives.

IN THIS REVIEW

AMT TracJet Laser Printer 224
Synergystex CF1000 Continuous Form Laser Printer 224
ALPS LSX1600 230
Compaq PageMarq 15 233
Compaq PageMarq 20 233
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OTC LaserMatrix 1000 Model 5 245
Printronix L1016 Continuous Form Laser Printer 247
QMS-PS 1700 248
TI microLaser XL Turbo 249

NETWORK NEEDS

High-capacity, flexible paper handling for high-volume environments is important for most larger networks, and few of the printers in this review will disappoint in that respect. Each of the new Compaq printers, for example, features "TwinTrays," which accommodate 500 sheets of letter-size paper in two 250-sheet stacks. (You get three TwinTrays standard with the 20-ppm PageMarq 20; with the 15-ppm PageMarq 15, you get one TwinTray plus a regular 250-sheet paper tray.) When the first stack empties, the motorized tray moves the replacement stack into place. At last, a printer that can refill its own paper trays!

Other printers that accommodate a full ream (500 sheets) of paper in a single cassette include the ALPS LSX1600 ($3,295) and the QMS-PS 1700 ($6,995), which provides two such trays in its standard configuration. The Kentek K30D not only has the honor of being the printer with the fastest engine (30 ppm) as well as the highest price (over $20,000) in this issue, but it also accommodates 550 sheets in one of the two cassettes included in its standard configuration. The continuous-form lasers, of course, have no limits on paper capacity—they'll accept however many fanfold sheets there are in the stack.

The Genicom Model 7170 ($4,495) and the Toshiba PageLaser GX400 ($4,499) offer only two 250-sheet paper cassettes as standard but take the prize for providing the most extensive paper handling upgrades. Both printers can be equipped with stackable options such as a 1,500-sheet input and output bin, a collator for printing up to ten sorted copies of a report, and a duplexer for printing on both sides of a page. Among those that offer built-in duplexing and high-capacity input trays are Digital Equipment and Kentek Information Systems.

On big networks, paper output is just as important an issue as paper input. In this review, you'll find a number of printers that include more than a single faceup (reverse order) output tray standard. See the features table for a quick look at which these are and the fact files for information on output tray options.

If you are going to have many users with different applications sharing a printer, you will also probably want a unit that supports more than one emulation. All but the Printronix device in this review support HP PCL, and all but three have—or will soon have—Adobe PostScript support. For the most flexibility, you'll want a printer that can automatically sense the required mode based on the stream of data arriving from the PC and switch accordingly. Again, the features table provides a quick summarization of the products with this feature.

SPECIALIZED FEATURES

Among the printers we review here are systems whose range of features suit them to CAD, CAM, or desktop publishing environments. These features include higher resolutions, PostScript support, AppleTalk ports, and ledger-size (11- by 17-inch) printing capabilities.

In this review, the PageMarq 15 ($3,999) and the PageMarq 20 ($5,499), the Dataproducts LZR 1560 ($3,395), the NewGen TurboPS/1200T ($14,995), and the QMS-PS 1700 provide resolutions in PostScript mode higher than the standard 300 dots per inch. The Dataproducts LZR 1555 ($3,395) is unique among the PCL 5 printers; while support for the HPGL plotter language is built into PCL 5, the LZR 1555 also *directly* supports HPGL, and it offers 400-dpi output in

HIGHLIGHTS

Shared Lasers

SHARED LASER PRINTERS (those with engine speeds of 12 pages per minute or greater) will experience the greatest market growth over the next five years. Expect printer vendors to respond to the demand by expanding their product lines to encompass the shared laser printer market.

THE 16 PRINTERS with 12- to 30-ppm engines tested here sport a variety of network-ready abilities. These specialized features range from flexible paper handling (options for printing on both sides of a page or bins that can hold up to 1,500 sheets of paper) to network interface cards and automatic emulation sensing.

SOME OF THESE printers have features useful for CAD or DTP applications: higher resolutions, built-in Adobe PostScript, and support for 11- by 17-inch paper. Four continuous-form lasers accept pin-feed paper to handle invoice and other forms printing.

FOR PURE TEXT SPEED, the 30-ppm Kentek K30D was unmatched, with the Compaq PageMarqs' pulling impressive scores for their respective engine classes. The K30D also led on the PCL-mode Graphics Speed test; the PageMarq 20 and the QMS-PS 1700 tied for first place on the PostScript-mode Graphics Speed test.

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that mode. That makes it a good choice if you need high-speed black-and-white plots.

Although the HP LaserJet 4 and the HP LaserJet 4M (reviewed in the mainstream lasers section) are the first printers to offer direct support for graphics at resolutions above 300 dpi in PCL, the NewGen TurboPS/1200T (like its mainstream laser siblings) runs its PCL emulation under PostScript, which allows for 1,200- by 600-dpi text when the printer is set for PCL 4 output.

Five of the printers in this review—the offerings from Compaq, Dataproducts Corp., and NewGen Systems Corp.—make it easier to create larger camera-ready output by supporting ledger-size paper. All but the five-figure NewGen TurboPS/1200T reflect the tumbling prices for B-size (ledger-size) laser printing; the Dataproducts units lead the group with bargain-basement prices of $3,395 in their single-bin configurations. Like the TurboPS/1200T, the Dataproducts printers come with one 250-sheet letter-size and one 250-sheet ledger-size paper cassette, but only one paper bin, in their standard configurations. But you can purchase optional bins for the TurboPS/1200T or order the Dataproducts devices with two or three bins.

PORT OF CALL

These 16 printers provide a wide range of sharing strategies. With some, the sharing will be handled by simply attaching the printer via its parallel or serial port to a PC acting as a print server, or to an external print server like Intel PCEO's NetPort II. (For more information on print servers, see "Sharing the Wealth" in an upcoming issue.) Other printer vendors (in this review as well as in the mainstream lasers section) eliminate the hardware middleman by offering their own network interfaces.

Theoretically, a built-in network interface should simplify the process of using these printers on a network. In practice, that was not always the case. For this review, we asked the companies to send their network interface options for Novell's NetWare over Ethernet cabling. Those we saw in time for testing included network interface adapters from Compaq, Genicom Corp., and QMS.

The Genicom printer offered the easiest network interface setup of all, but setting up the Compaq and QMS units for use with their network interfaces was a lengthy, involved process.

We also had some problems conducting our PostScript-mode Text Speed test over the network. On this test, which sends a PostScript font command prior to sending the PostScript file, some of the printers (when hooked up via their network interfaces) assumed that two files were being sent. This resulted in a memory flush of the PostScript font command, making it impossible for the printer to output the PostScript file. While this feature assures you that you will not print any data that could be left in memory, it may also cause the loss of portions of the print job that were not received in the initial transmission, as it did with our test. (We solved the problem by adding the font commands to the PostScript-mode Text Speed test file.)

PERFORMANCE TEST RESULTS

Many of the printers in this group back up their fast engines with lots of memory and speedy RISC-based processors. We measured the performance of each of the 16 network printers as standalone devices and, if the company supplied a network interface, as printers with a direct attachment to a NetWare network.

The overall fastest printer on our Text and Graphics Speed tests was, not surprisingly, the Kentek K30D. With its 30-

PC MAGAZINE ▶ EDITORS' CHOICE

- **Compaq PageMarq 15**
- **Compaq PageMarq 20**

Compaq Computer Corp. enters the shared printer market in a big way with its first two offerings, the 15-page-per-minute Compaq PageMarq 15 ($3,999) and the 20-ppm Compaq PageMarq 20 ($5,499). These two printers proved to be among the most flexible units we saw, offering everything from Adobe PostScript Level 2 and HP PCL 5 to high-quality output, thanks in part to Compaq's Print Enhancement Technology (PET) and their 800- by 400-dot-per-inch (PostScript) resolution. If that's not enough to entice you, then their good speed, support for 11- by 17-inch paper, and wide selection of options (from a PostScript fax package to hard disks to network interfaces and a comprehensive NetWare administrator utility) should be.

Both printers provide their extensive range of capabilities at prices that will really give the 17-ppm HP LaserJet IIISi a run for its money. In its standard $5,495 configuration, the IIISi includes only 1MB of RAM and PCL 5, in contrast to the 4MB of RAM, PCL 5, and PostScript language support that come standard with each of the two PageMarqs. The PageMarq 20 also offers a 1,500-sheet capacity in its standard configuration—500 sheets more than the IIISi supplies.

The PageMarqs give you the benefit of features such as automatic emulation sensing and simultaneously active ports, in addition to port priority settings and automatic interface switching.

New and notable on the two Compaq printers are motorized paper trays. Each "TwinTray" holds up to 500 sheets of letter-size paper in two stacks; when you run out of paper in the first stack, the tray automatically moves the second stack into position and feeds paper from it. Three TwinTrays come standard with the PageMarq 20, adding to its appropriateness as an option for larger networks. With its slower RISC processor and 750-sheet paper capacity in its standard configuration (you can substitute a second TwinTray for the standard letter-size tray that occupies the second bin), the PageMarq 15 is better suited for medium-size workgroups.

Both are appropriate for supplying plotter-size draft output for CAD and CAM users. Even though an 11- by 17-inch paper cassette is an $89 option, the extra cost doesn't keep either printer from being competitive with the new lower prices we're beginning to see for B-size lasers.

When it comes to performance, these units come up winners. Text Speed test scores for the PageMarq 15 and PageMarq 20 in both PCL (12.8 ppm and 16.5 ppm, respectively) and PostScript (12.8 ppm and 17.2 ppm) modes were admirable for their respective classes, as were their PostScript-mode Graphics Speed test scores. The PageMarqs' PCL-mode Graphics Speed test scores left something to be desired and, as with all the printers in this review that were tested with their network interfaces, setting these units up in that configuration was not an easy task. But aside from that, about the only place the PageMarq printers fall short is in their lack of options for duplexing and collating. And unless those features are essential for your network needs, don't let them stop you from putting these two at the top of your list.

HONORABLE MENTION

The Dataproducts LZR 1555 and the Dataproducts LZR 1560 rate as honorable mentions in this roundup of shared laser printers. With support for ledger-size printing at the incredibly low list price of $3,395 each (with two paper trays but only one paper bin), these two provide some of the best bargains in the business. You can have two or more paper trays in place at the same time if you purchase these units with two or three bins ($3,595 and $3,795, respectively). A fairly complete features set includes PCL 5 and HPGL support in the LZR 1555, and PCL 4 and PostScript Level 2 in the LZR 1560. Both units offer 400-dpi output—in HPGL mode for the LZR 1555 and in PostScript mode for the LZR 1560.

PCL-mode Text Speed test scores for both printers were similarly good for 15-ppm models (12.5 ppm for the LZR 1555 and 12.3 ppm for the LZR 1560), but the LZR 1560 lagged behind the 15-ppm pack on the PCL-mode Graphics Speed test while the LZR 1555 was at the forefront. The LZR 1560 performed better in PostScript mode—fitting for a printer geared toward the desktop publishing market. Output is good, but it could be better with some form of resolution enhancement.

The units from Dataproducts Corp. aren't as strong as the two Compaq devices in features that can be valuable on a network. For instance, they can't switch ports or emulations automatically, nor does the company offer Ethernet or Token-Ring network interfaces. But if you're looking for extremely affordable ledger-size printing in a solidly built unit, either of these systems will do nicely.

ALSO OF NOTE

Some other systems in this review are worthy of mention here for their excellence in specific areas.

The 30-ppm Kentek K30D is unmatched for pure speed, but with a list price of over $20,000, you really must have a pressing need for its fast performance and 150,000-page rated duty cycle. Both the 17-ppm Genicom Model 7170 ($4,495) and the Toshiba PageLaser GX400 ($4,499) excel in paper handling options that add little to each printer's footprint, making them particularly appropriate in tight quarters. And the QMS-PS 1700 mixes a competitive $6,995 price with good performance and an array of network options that includes a $250 administrator security card that will keep workgroup users from disturbing the printer's configuration settings. Finally, if you have special needs such as forms or label printing, you may be interested in the OTC LaserMatrix 1000 Model 5 ($5,695). Features such as a RISC processor, support for PCL 5, and the ease with which you can adjust fuser temperature (in order to use the least possible heat for different media) help make this model stand out among the continuous-form laser printers.

ppm engine and 33-MHz Intel i860, the K30D ran through our PCL-mode Text Speed test at 27 ppm and breezed through the Graphics Speed test at 5.5 gppm. On our PostScript-mode Text Speed test, the K30D maintained its dominance, with a score of 26.9 ppm. But its graphics performance suffered substantially—it dropped to last place with a score of 0.2 gppm. Its fast Microsoft Windows scores on all but the Direct Print and Print from File versions of the CorelDRAW test in PostScript mode mirror its Text and Graphics Speed performance.

The 20-ppm Compaq PageMarq 20 had an impressive PCL-mode Text Speed test score of 16.5 ppm, but fell short on graphics printing, managing only 1.8 gppm. The PageMarq 15 was similarly affected with slow PCL graphics printing, although its 1.4-gppm score was almost twice as fast as the Dataproducts LZR 1560's. On the other hand, the LZR 1555's PCL-mode Graphics Speed test score was, at 2.1 gppm, a comfortable distance ahead of the PageMarq 15's. In PostScript mode, the PageMarq 20 took second place to the Kentek K30D, with an admirable 17.2-ppm Text Speed test score; its 1.1 gppm tied for first place with the QMS-PS 1700 on the Graphics Speed test.

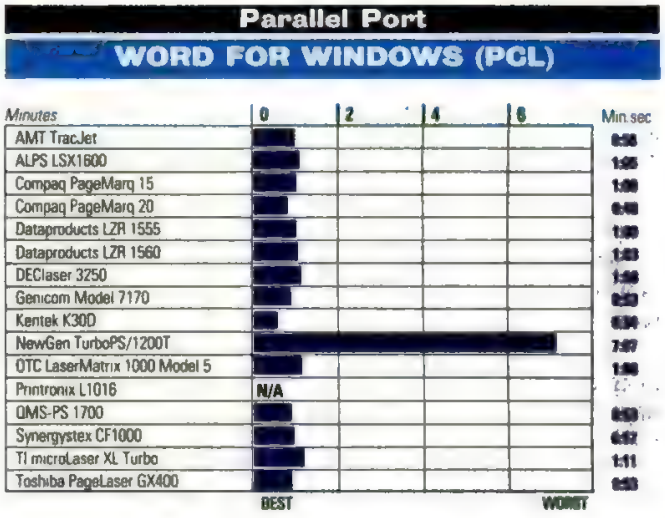
The 12-ppm NewGen TurboPS/1200T had the slowest engine rating of all the network printers; expectedly, it produced the slowest results overall on our performance tests. What was less expected was the fact that its PCL scores were slower than some of the 10-ppm devices reviewed in this issue. As with the NewGen products reviewed in the mainstream lasers section, this printer is intended principally for PostScript use; this may partially explain its somewhat lackluster PCL performance, as well as its inability to pass our PCL 4 Torture Test.

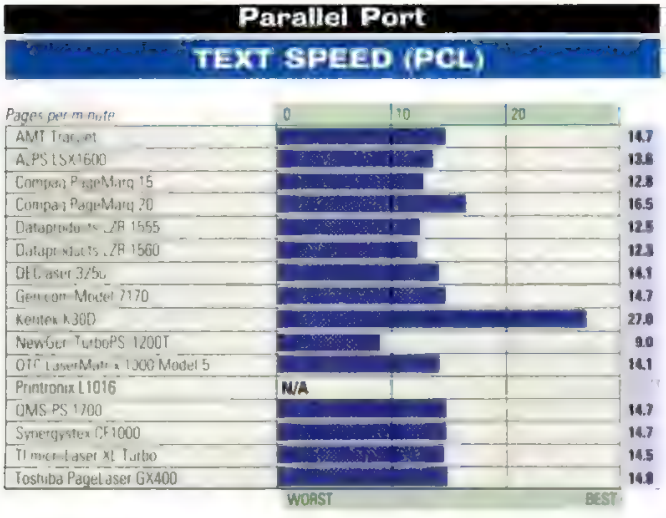
Test results using the network interfaces that came with some of these printers were slower than results obtained via the parallel port, but not significantly so. We expected to see some decrease in speed because of factors like network overhead.

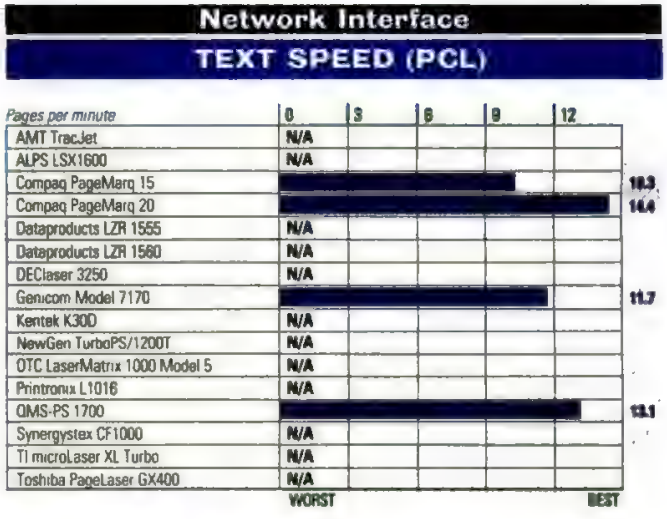
CONTINUES

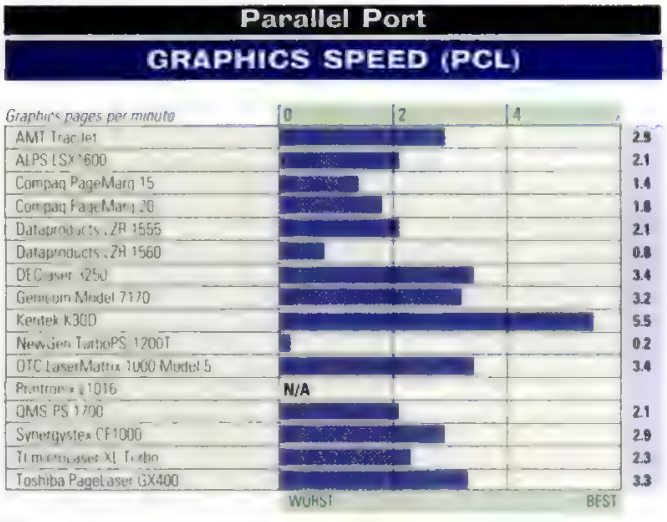
Not surprisingly, the fastest printer on our PCL Text Speed and Graphics Speed tests was the 30-ppm Kentek K30D, logging in at 27 ppm and 5.5 gppm. It maintained its lead on PostScript Text Speed but fell to last place on our PostScript Graphics Speed test.

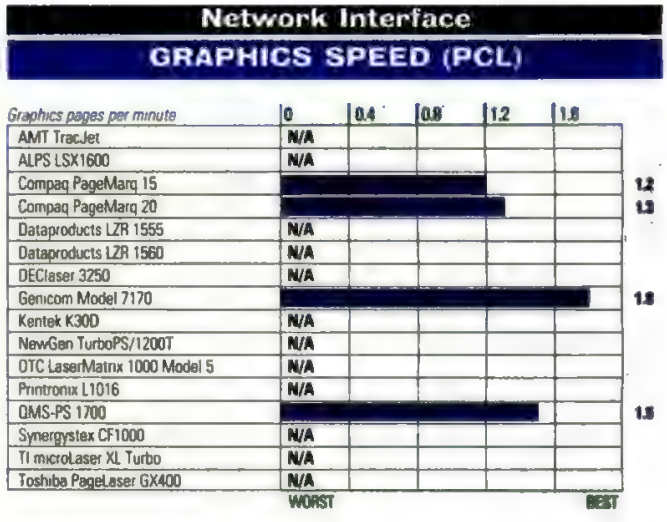
The 20-ppm Compaq PageMarq 20's PCL and PostScript Text Speeds were impressive for a 20-ppm printer. On our PostScript Graphics Speed test, the PageMarq 20 tied with the 17-ppm QMS-PS 1700 for first place among the products reviewed.











N/A—Not applicable The printer could not perform this test

Performance Tests: Shared Lasers

CONTINUES

Parallel Port
CORELDRAW (POSTSCRIPT)

Print Direct / Print from File

Minutes	0	1	2	3	4	Min sec
AMT TracJet	N/A N/A					
ALPS LSX1600	N/A N/A					
Compaq PageMarq 15						0:59 1:01
Compaq PageMarq 20						0:53 0:55
Dataproducts LZR 1555	N/A N/A					
Dataproducts LZR 1560						1:28 1:46
DEClaser 3250						2:14 2:17
Genicom Model 7170	N/A N/A					
Kentek K30D						4:06 3:56
NewGen TurboPS/1200T						1:18 1:21
OTC LaserMatrix 1000 Model 5	N/A N/A					
Printronix L1016						1:43 1:43
QMS-PS 1700						0:51 0:53
Synergystex CF1000	N/A N/A					
TI microLaser XL Turbo						1:12 1:06
Toshiba PageLaser GX400						2:22 2:16

BEST — WORST

Parallel Port
TEXT SPEED (POSTSCRIPT)

Pages per minute	0	10	20	
AMT TracJet Laser Printer	N/A			
ALPS LSX1600	N/A			
Compaq PageMarq 15				12.8
Compaq PageMarq 20				17.2
Dataproducts LZR 1555	N/A			
Dataproducts LZR 1560				13.1
DEClaser 3250				10.9
Genicom Model 7170	N/A			
Kentek K30D				26.9
NewGen TurboPS/1200T				9.6
OTC LaserMatrix 1000 Model 5	N/A			
Printronix L1016				14.8
QMS-PS 1700				14.4
Synergystex CF1000	N/A			
TI microLaser XL Turbo				14.8
Toshiba PageLaser GX400				14.7

WORST — BEST

Parallel Port
GRAPHICS SPEED (POSTSCRIPT)

Graphics pages per minute	0	0.3	0.6	0.9	
AMT TracJet Laser Printer	N/A				
ALPS LSX1600	N/A				
Compaq PageMarq 15					1.0
Compaq PageMarq 20					1.1
Dataproducts LZR 1555	N/A				
Dataproducts LZR 1560					0.6
DEClaser 3250					0.4
Genicom Model 7170	N/A				
Kentek K30D					0.2
NewGen TurboPS/1200T					0.7
OTC LaserMatrix 1000 Model 5	N/A				
Printronix L1016					0.6
QMS-PS 1700					1.1
Synergystex CF1000	N/A				
TI microLaser XL Turbo					0.9
Toshiba PageLaser GX400					0.4

WORST — BEST

N/A—Not applicable. The printer could not perform this test

Parallel Port
WORD FOR WINDOWS (POSTSCRIPT)

Minutes	0	0.4	0.8	1.2	1.6	Min sec
AMT TracJet Laser Printer	N/A					
ALPS LSX1600	N/A					
Compaq PageMarq 15						1:06
Compaq PageMarq 20						0:45
Dataproducts LZR 1555	N/A					
Dataproducts LZR 1560						1:00
DEClaser 3250						1:27
Genicom Model 7170	N/A					
Kentek K30D						0:27
NewGen TurboPS/1200T						1:55
OTC LaserMatrix 1000 Model 5	N/A					
Printronix L1016						1:10
QMS-PS 1700						0:58
Synergystex CF1000	N/A					
TI microLaser XL Turbo						1:12
Toshiba PageLaser GX400						1:13

BEST — WORST

Network Interface
TEXT SPEED (POSTSCRIPT)

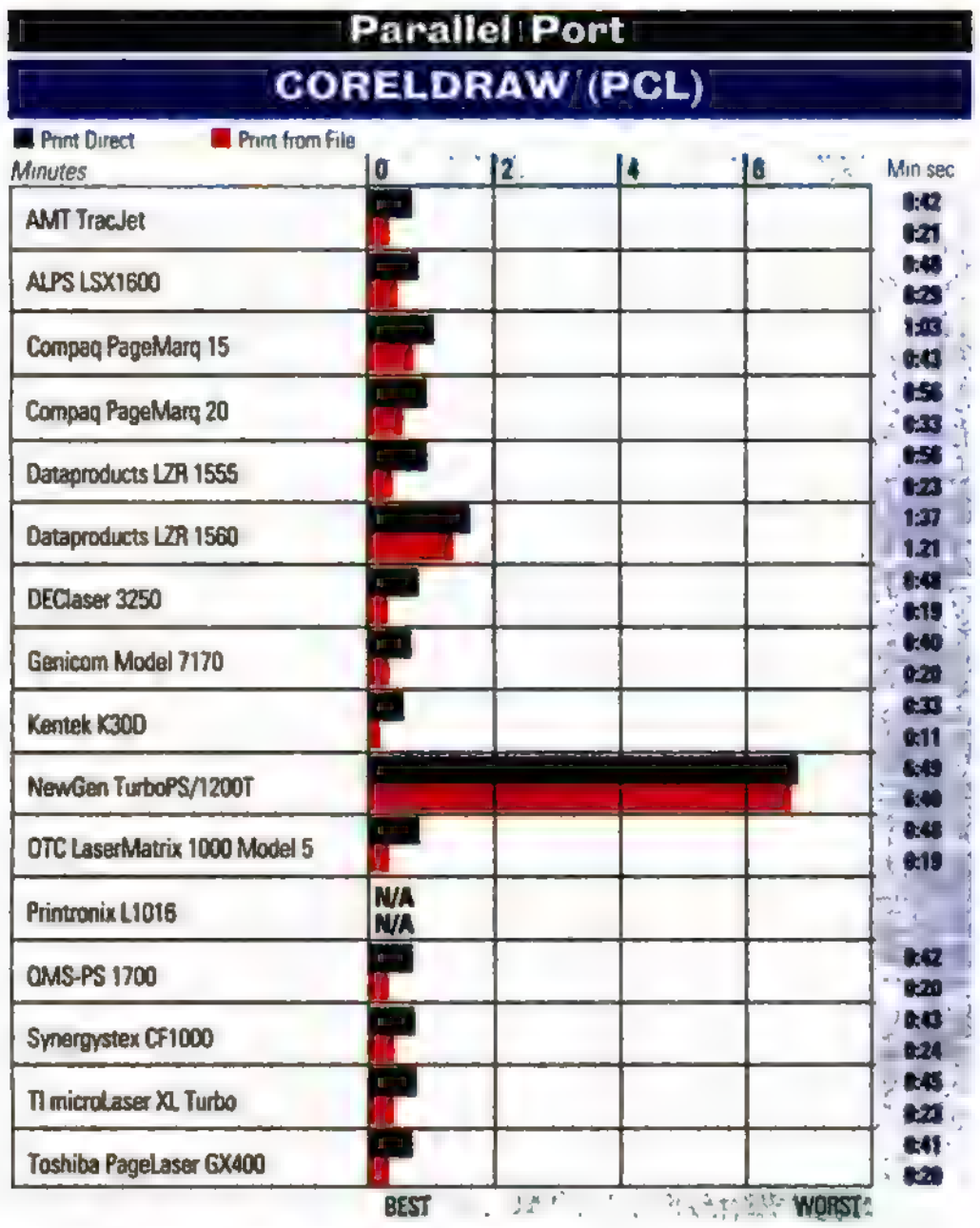
Pages per minute	0	3	6	9	12	
AMT TracJet Laser Printer	N/A					
ALPS LSX1600	N/A					
Compaq PageMarq 15						10.6
Compaq PageMarq 20						12.8
Dataproducts LZR 1555	N/A					
Dataproducts LZR 1560	N/A					
DEClaser 3250	N/A					
Genicom Model 7170	N/A					
Kentek K30D	N/A					
NewGen TurboPS/1200T	N/A					
OTC LaserMatrix 1000 Model 5	N/A					
Printronix L1016	N/A					
QMS-PS 1700						11.6
Synergystex CF1000	N/A					
TI microLaser XL Turbo	N/A					
Toshiba PageLaser GX400	N/A					

WORST — BEST

Network Interface
GRAPHICS SPEED (POSTSCRIPT)

Graphics pages per minute	0	0.1	0.2	0.3	
AMT TracJet Laser Printer	N/A				
ALPS LSX1600	N/A				
Compaq PageMarq 15					0.4
Compaq PageMarq 20					0.4
Dataproducts LZR 1555	N/A				
Dataproducts LZR 1560	N/A				
DEClaser 3250	N/A				
Genicom Model 7170	N/A				
Kentek K30D	N/A				
NewGen TurboPS/1200T	N/A				
OTC LaserMatrix 1000 Model 5	N/A				
Printronix L1016	N/A				
QMS-PS 1700					0.4
Synergystex CF1000	N/A				
TI microLaser XL Turbo	N/A				
Toshiba PageLaser GX400	N/A				

WORST — BEST



N/A—Not applicable: The printer could not perform this test

ENDS

We performed each test in PCL mode and again in PostScript mode, for those printers that support it.

The **Text Speed** test measures the printer's speed in sending and printing ten copies of a two-page business letter with 1-inch margins in 10-cpi type. Besides running this test via each printer's parallel port, we also tested the performance via a network interface card in cases where the vendor had supplied one.

The **Graphics Speed** test measures the printer's speed in sending and printing two copies of a graphics image created using CorelDRAW and Microsoft Windows 3.1. Besides running this test via each printer's parallel port, we also tested the performance via a network interface card in cases where the vendor had supplied one.

The **Word for Windows** test records the time required to print a ten-page business report that uses multiple fonts and type styles. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

The **CorelDRAW** test measures the time required to print a CorelDRAW graphics file. We run the test in two different ways: first as a direct print from within the application (Direct Print) and then as a print of a pregenerated file external to the application (Print from File). It uses the same graphics file as the Graphics Speed test does. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

COMING UP

By the time you read this, even more high-speed printers will have entered the field, including the 32-ppm QMS-PS 3200 ($19,995), the 20-ppm Olympus IS2030 electron imaging printer, and Digital's 32-ppm PrintServer 32 ($23,900). Others that could not meet our deadline for testing were Advanced Technologies International's $5,995 15-ppm ATI LC6815 and 30-ppm AT 7030 (available in a $16,485 simplex and $21,430 duplex version); Rosetta Technology's $4,995 16-ppm RT3216, and 30-ppm RT4330 and RT530; and Xerox's 13-ppm 4213 ($4,795). Also, we learned about Talaris Systems' 1794 Print Station ($6,495), a 17-ppm printer that uses the Canon NX engine, too late to include it here.

Shared lasers are faster and more affordable than ever. And as the competition heats up, expect to see even lower prices, more printers with fast engines, and a continued trend toward differentiated features for specific missions.

Advanced Matrix Technology Inc.

AMT TracJet Laser Printer

Synergystex International Inc.

Synergystex CF1000 Continuous Form Laser Printer

BY JOHN R. QUAIN

Tractor-feed page printers may seem like an odd cross between dot matrix and laser printers, but the capacity and speed of Advanced Matrix Technology's AMT TracJet Laser Printer and the Synergystex CF1000 Continuous Form Laser Printer rival that of impact line printers—and these two printers deliver superior laser output of 300 dots per inch.

Each of these 16-ppm hybrids lists for $4,995 and has HP PCL 4 emulation. The two printers are virtually identical, from the outside in. They use the same desktop chassis and control panel, and they come standard with a Centronics parallel port and a serial port. Each printer also accepts up to two HP LaserJet II–compatible font cartridges.

The units rely on a Pentax PL-F0301 continuous-form laser engine and a Carlisle controller with a 12.5-MHz Intel 80186 processor and 2MB of memory. You can add up to 8MB total to each; a 6MB memory upgrade from AMT is considerably more costly.

Each printer turned in the same good scores for their class of 16-ppm models: 14.7 pages per minute and 2.9 graphics pages per minute on PC Magazine Labs' PCL-mode tests.

The print quality for both the AMT and the Synergystex, despite their lack of any resolution enhancement technology, was good. Images and text were appropriately dark and fully saturated. When dealing with differently coated paper stocks, users can adjust the print density using a manual dial under the printers' hoods.

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AMT Traojet Laser Printer — $4,995

16-ppm Pentax PL-F0301 engine-based continuous-form laser printer with HP PCL 4

Courier Bold
Line Printer

PCL Text Speed: 14.7 ppm
PCL Graphics Speed: 2.9 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 0 min. 58 sec.
CorelDRAW (Direct): 0 min. 42 sec.
CorelDRAW (File): 0 min. 21 sec.

ALPS LSX1600 — $3,295

16-ppm MKE Matsushta V5000 engine-based laser printer with HP PCL 4; ALPScript PostScript interpreter, $695

Line Printer
Courier

PCL Text Speed: 13.6 ppm
PCL Graphics Speed: 2.1 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 05 sec.
CorelDRAW (Direct): 0 min. 48 sec.
CorelDRAW (File): 0 min. 29 sec.

Compaq PageMarq 15 — $3,999

PC MAGAZINE EDITORS' CHOICE

15-ppm Fuji Xerox engine-based B-size laser printer with 800- by 400-dpi output, Adobe PostScript Level 2, HP PCL 5

Couier
Helvetica
Palatino
Times

PCL Text Speed: 12.8 ppm
PCL Text (NIC): 10.3 ppm
PCL Graphics Speed: 1.4 gppm
PCL Graphics (NIC): 1.2 gppm
PS Text Speed: 12.8 ppm
PS Text (NIC): 10.6 ppm
PS Graphics Speed: 1.0 gppm
PS Graphics (NIC): 0.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 00 sec.
CorelDRAW (Direct): 1 min. 03 sec.
CorelDRAW (File): 0 min. 43 sec.

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 06 sec.
CorelDRAW (Direct): 0 min. 59 sec.
CorelDRAW (File): 1 min. 01 sec.

Compaq PageMarq 20 — $5,499

PC MAGAZINE EDITORS' CHOICE

20-ppm Fuji Xerox engine-based B-size laser printer with 800- by 400-dpi output, Adobe PostScript Level 2, HP PCL 5

CG Times
Universal
Courier Bold
Palatino

PCL Text Speed: 16.5 ppm
PCL Text (NIC): 14.4 ppm
PCL Graphics Speed: 1.8 gppm
PCL Graphics (NIC): 1.3 gppm
PS Text Speed: 17.2 ppm
PS Text Speed (NIC): 12.8 ppm
PS Graphics Speed: 1.1 gppm
PS Graphics (NIC): 0.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 0 min 48 sec
CorelDRAW (Direct): 0 min. 56 sec.
CorelDRAW (File): 0 min. 33 sec.

PS WINDOWS APPLICATIONS:
Word for Windows: 0 min. 49 sec.
CorelDRAW (Direct): 0 min. 53 sec.
CorelDRAW (File): 0 min. 55 sec.

Dataproducts LZR 1555 — $3,395

15-ppm Fuji Xerox XP-15 engine-based B-size laser printer with 400-dpi output, HP GL, HP PCL 5

Dutch
Zurich
Courier
Line Printer

PCL Text Speed: 12.5 ppm
PCL Graphics Speed: 2.1 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 00 sec.
CorelDRAW (Direct): 0 min. 56 sec.
CorelDRAW (File): 0 min. 23 sec.

Dataproducts LZR 1560 — $3,395

15-ppm Fuji Xerox XP-15 engine-based B-size laser printer with 400-dpi output, Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 12.3 ppm
PCL Graphics Speed: 0.8 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 03 sec.
CorelDRAW (Direct): 1 min. 37 sec.
CorelDRAW (File): 1 min. 21 sec.

PS Text Speed: 13.1 ppm
PS Graphics Speed: 0.6 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 09 sec.
CorelDRAW (Direct): 1 min. 28 sec.
CorelDRAW (File): 1 min. 46 sec.

Courier Bold
Palatino
Times Roman
Helvetica

DEClaser 3250 — $4,799

13-ppm Xerox engine-based laser printer with DEC PPL3 emulation, HP PCL 4, Xerox PostScript Level 1 Interpreter

PCL Text Speed: 14.1 ppm
PCL Graphics: 3.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 09 sec.
CorelDRAW (Direct): 0 min. 48 sec.
CorelDRAW (File): 0 min. 19 sec.

PS Text Speed: 10.9 ppm
PS Graphics Speed: 0.4 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 27 sec.
CorelDRAW (Direct): 2 min. 14 sec.
CorelDRAW (File): 2 min. 17 sec.

Courier
Lineprinter
Times
Palatino

Genicom Model 7170 — $4,495

17-ppm Toshiba G750 engine-based laser printer with HP PCL 5; GeniScript PostScript Level 1 interpreter, $895

PCL Text Speed: 14.7 ppm
PCL Text (NIC): 11.7 ppm
PCL Graphics Speed: 3.2 gppm
PCL Graphics (NIC): 1.8 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 0 min. 53 sec.
CorelDRAW (Direct): 0 min. 40 sec.
CorelDRAW (File): 0 min. 20 sec.

CG Times
Univers
Courier
Line Printer

Kentek K30D — $23,740

30-ppm K30D engine-based laser printer with HP PCL 5; PhoenixPage PostScript Level 1 interpreter, $695

PCL Text Speed: 27.0 ppm
PCL Graphics Speed: 5.5 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 0 min. 34 sec.
CorelDRAW (Direct): 0 min. 33 sec.
CorelDRAW (File): 0 min. 11 sec.

PS Text Speed: 26.9 ppm
PS Graphics Speed: 0.2 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 0 min. 27 sec.
CorelDRAW (Direct): 4 min. 08 sec.
CorelDRAW (File): 3 min. 56 sec.

Arial
Brougham
Courier
Times New Roman

NewGen TurboPS/1200T — $14,995

12-ppm Copal engine-based B-size laser printer with 1,200-by-600 dpi output, HP PCL4, NewGen PostScript interpreter

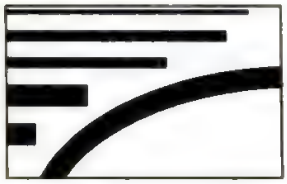
PCL Text Speed: 9.0 ppm
PCL Graphics Speed: 0.2 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 7 min. 07 sec.
CorelDRAW (Direct): 6 min. 49 sec.
CorelDRAW (File): 6 min. 40 sec.

PS Text Speed: 9.6 ppm
PS Graphics Speed: 0.7 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 55 sec.
CorelDRAW (Direct): 1 min. 18 sec.
CorelDRAW (File): 1 min. 21 sec.

Times
Helvetica
Courier Bold
Palatino



OTC LaserMatrix 1000 Model 5 — $5,695

16-ppm Asahi Optical FL1000 engine-based continuous-form laser printer with HP PCL 5

PCL Text Speed: 14.1 ppm
PCL Graphics Speed: 3.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 08 sec.
CorelDRAW (Direct): 0 min. 48 sec.
CorelDRAW (File): 0 min. 19 sec.

Line Printer
CG Times
Univers
Courier

Printronix L1016 Continuous Form Laser Printer — $8,285

16-ppm Pentax PL-F0301 engine-based continuous-form laser printer; PhoenixPage PostScript interpreter, $995

PS Text Speed: 14.8 ppm
PS Graphics Speed: 0.6 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 10 sec.
CorelDRAW (Direct): 1 min. 43 sec.
CorelDRAW (File): 1 min. 43 sec.

Palatino
Helvetica
Times
Courier-Bold

QMS-PS 1700 — $6,995

17-ppm Canon NX engine-based laser printer with 600-dpi output, Adobe PostScript, HPGL, HP PCL 4

PCL Text Speed: 14.7 ppm
PCL Text (NIC): 13.1 ppm
PCL Graphics Speed: 2.1 gppm
PCL Graphics (NIC): 1.5 gppm
PS Text Speed: 14.4 ppm
PS Text Speed (NIC): 11.6 ppm
PS Graphics Speed: 1.1 gppm
PS Graphics (NIC): 0.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 0 min. 53 sec.
CorelDRAW (Direct): 0 min. 42 sec.
CorelDRAW (File): 0 min. 20 sec.

PS WINDOWS APPLICATIONS:
Word for Windows: 0 min. 58 sec.
CorelDRAW (Direct): 0 min. 51 sec.
CorelDRAW (File): 0 min. 53 sec.

Times
Helvetica
Courier Bold
Palatino

Synergystex CF1000 Continuous Form Laser Printer — $4,995

16-ppm Pentax PL-F0301 engine-based continuous-form laser printer with HP PCL 4

PCL Text Speed: 14.7 ppm
PCL Graphics Speed: 2.9 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 0 min. 57 sec.
CorelDRAW (Direct): 0 min. 43 sec.
CorelDRAW (File): 0 min. 24 sec.

Line Printer
Courier

TI microLaser XL Turbo — $3,649

16-ppm Sharp JX9700 engine-based laser printer with Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 14.5 ppm
PCL Graphics Speed: 2.3 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 1 min. 11 sec.
CorelDRAW (Direct): 0 min. 45 sec.
CorelDRAW (File): 0 min. 23 sec.

PS Text Speed: 14.8 ppm
PS Graphics Speed: 0.9 gppm

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 12 sec.
CorelDRAW (Direct): 1 min. 12 sec.
CorelDRAW (File): 1 min. 06 sec.

Courier
Universal
Times
Palatino

Announcing POSTNET Bar Code Capabilities

Many Forms. Many Users. One Printer.

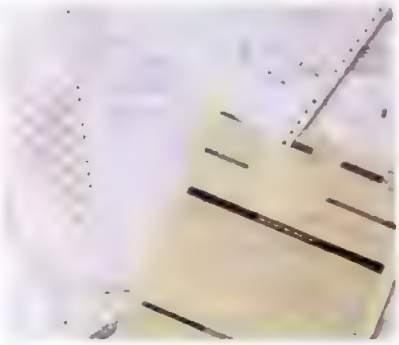
The TI 8900 Series — cost-cutting shared printers for forms and more.

Now you can get a single forms printer that can do the job of several machines — print up to nine-part forms, letters, labels, envelopes and other documents. The 8900 Series is a solution that not only makes sense, it saves money.

Starting at only $2,345*, an 8900 Series printer is one of the fastest shared printers in its class, with more features and a size that's only slightly larger than your personal printer.

Because of its impressive list of paper-handling features — zero tear-off, paper parking, top-of-form sensing and more — an 8900 Series printer can be used in all kinds of forms applications easily. It automatically adjusts to form width, length and thickness, making form waste and misaligned paper a thing of the past.

You can also say goodbye to complicated controls. Now you can select options like print quality (ranging from letter-quality 100 cps to Rapid Print 600 cps), font styles, menu status and more by simply touching a Powerkey™ button. Some models even print color graphs or highlight reports with up to seven colors.



TI's 8900 Series prints a variety of forms — and more.

CIRCLE 304 ON READER SERVICE CARD

What's more, with its 16,000 pages-per-month** output capability, an 8900 Series printer is so reliable it can even replace some line printers.

All this adds up to a cost-cutting printer solution you won't find anywhere else. And now save even more on Automated Postage Rates. Save money and time on bulk postage with the speed and versatility of a POSTNET bar code option for the 8900 printers. For more information, call **1-800-527-3500**.

TEXAS INSTRUMENTS

76570 ©1992 TI

*TI suggested list price. **Based upon 2,000 characters per page. Powerkey is a trademark of Texas Instruments Incorporated.

Toshiba PageLaser GX400 **$4,499**

17-ppm Toshiba G750 engine-based laser printer with HP PCL 5; Toshiba PDL PostScript interpreter, $999

PCL Text Speed: 14.8 ppm
PCL Graphics Speed: 3.3 gppm
PS Text Speed: 14.7 ppm
PS Graphics Speed: 0.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 0 min. 53 sec.
CorelDRAW (Direct): 0 min. 41 sec.
CorelDRAW (File): 0 min. 20 sec.

PS WINDOWS APPLICATIONS:
Word for Windows: 1 min. 13 sec.
CorelDRAW (Direct): 2 min. 22 sec.
CorelDRAW (File): 2 min. 18 sec.

THE MAIN EVENT

The main attraction of these printers is their form- and label-printing abilities. With a box of fanfold paper, each unit can print up to 5,000 sheets without reloading. Both handle Avery-size labels easily, as well as most varieties of specialized labels down to 3 inches wide. Form lengths can be adjusted (in increments of one-sixth or one-eighth of an inch) up to 33 inches in length. Maximum paper width is 9.5 inches (pin-to-pin). Both are rated for paper weights up to 24 pounds, but because of their straight paper path, these two can manage heavier weights than the manufacturers recommend—including thin to medium card stock.

AMT TracJet Laser Printer, Synergystex CF1000 Continuous Form Laser Printer

The control panel of these printers is not state-of-the-art, but the LCD messages are in plain English. You can set such common parameters as the number of copies (1 to 99), serial-port baud rate, and font choice. The 16-character LCD panel also will alert you when the toner life or OPC drum life has been exceeded.

Where these two continuous-form lasers diverge is in the options each company offers. AMT offers factory-installed emulations, including IBM Proprinter ($95) and OCR-A ($95). Synergystex offers a $3,795 unwinder/slitter/rewinder option for managing paper rolls up to 12 inches in diameter. The three-part consumables and common options tend to cost a little more from AMT, but dealer prices may vary. AMT charges $650 for an extra year of on-site service from Bull HN Information Systems ($795 after your warranty expires); Synergystex charges $755.

Since the AMT and Synergystex printers are identically priced and configured, buyers will doubtless base their buying decision on dealer discounts, which should range between 10 and 15 percent.

Advanced Matrix Technology Inc., *765 Flynn Rd., Camarillo, CA 93012; 800-992-2264, 805-388-5799; fax, 805-494-3087.*

AMT TracJet Laser Printer *List price: $4,995. 2MB RAM upgrade, $295; 4MB RAM upgrade, $585; 6MB RAM upgrade, $865; IBM Proprinter or OCR-A emulation, $95 each; Coax or Twinax option, $2,000; drum, $310; developer, $340; toner cartridge, $120. Dimensions (HWD): 7.3 x 18 x 20.5 inches. Weight: 43 pounds. Emulations: HP PCL 4.*
Circle 503 on reader service card

Synergystex International Inc., *3065 Nationwide Pkwy., Brunswick, OH 44212; 216-225-3112; fax, 216-225-0419.*

Synergystex CF1000 Continuous Form Laser Printer *List price: $4,995. 6MB RAM upgrade, $450; text label and bar code cartridges, $195 each or $375 for both; twinax or coax option, $1,295; unwinder/slitter/rewinder unit, $3,795; drum, $205; developer, $310; toner cartridge, $99. Dimensions (HWD): 7.3 x 18 x 20.5 inches. Weight: 43 pounds. Emulations: HP PCL 4.*
Circle 504 on reader service card

ALPS America

ALPS LSX1600

BY ANGELA GUNN

The $3,295 ALPS LSX1600, from ALPS America, will appeal to those network users looking for PCL 4 functionality in an inexpensive package.

The 16-ppm LSX1600 uses a Matsushta MKE V5000 engine; the built-in controller is from Adaptec. The unit hooks up via a parallel or serial port and ships with 1MB of RAM; this can be upgraded to 7MB total via standard SIMMs.

On our PCL-mode performance tests, the LSX1600 produced one of the slowest scores in its class for Text Speed: 13.6 pages per minute. Its Graphics Speed score—2.1 graphics pages per minute—was better, though not outstanding. The printer's unenhanced, 300-dpi output quality was good, though some detail was lost in the highlights.

ALPS LSX1600

ALPS' proprietary version of PostScript—ALPScript—should be available through a $695 emulation cartridge by the time you read this, though it was not ready in time for testing. The cartridge will add support for 35 PostScript fonts.

The ALPS LSX1600 comes standard with two multipurpose paper bins. One holds 500 letter-, legal-, or A4-size sheets;

Photographs by Thom O'Connor

SYDOS INTRODUCES THE FAST CAT WITHOUT THE FAT CAT PRICE.

REMOVABLE CARTRIDGE DISK DRIVE. In today's wild, fast-paced world of computer technology, there's a new breed of storage systems out there. It's PUMA, The Fast Cat from SyDOS—the ultimate, easy to use, removable cartridge disk drive.

UNLIMITED CAPACITY. In the heart of every PUMA drive beats the proven performance of Winchester hard disk technology—plus one major benefit. You can use as many cartridges as you want for totally unlimited storage capacity.

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CIRCLE 279 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

Shared Lasers

Products listed in alphabetical order

■ = YES □ = NO

	AMT TracJet Laser Printer	ALPS LSX1600	Compaq PageMarq 15 (PC EDITOR'S CHOICE)	Compaq PageMarq 20 (PC EDITOR'S CHOICE)	Dataproducts LZR 1555	Dataproducts LZR 1560
List price	$4,995	$3,295	$3,999	$5,499	$3,395	$3,395
Engine						
Engine type	Laser	Laser	Laser	Laser	Laser	Laser
Model	Pentax PL-F0301	MKE Matsushta V50	Fuji Xerox	Fuji Xerox	Fuji Xerox XP-15	Fuji Xerox XP-15
Rated speed (pages per minute) *	16	16	15	20	15	15
Paper support	Continuous-form	Cut-sheet	Cut-sheet	Cut-sheet	Cut-sheet	Cut-sheet
Single-cartridge toner/developer/drum	□	□	■	■	■	■
Toner capacity (copies)	4,000	10,000	12,000	12,000	12,000	12,000
Total installable memory	8MB	7MB	18MB	20MB	16MB	16MB
Standard or proprietary	Standard	Standard	Standard	Standard	Standard	Standard
Maximum resolution (dpi)	300 x 300	300 x 300	800 x 400	800 x 400	400 x 400	400 x 400
Processor on controller	12.5-MHz Intel 80186	16-MHz Motorola MC688	16-MHz AMD 29000	20-MHz AMD 29000	20-MHz Motorola 68020	7.25-MHz Weitek 8200
RISC	□	□	■	■	□	■
Interfaces						
Parallel	■	■	■	■	■	■
Serial	■	■	■	■	■	■
SCSI	□	□	□	□	□	■ (for hard disk storage only)
AppleTalk	□	□	Optional	Optional	□	■
Ethernet	□	□	Optional	Optional	□	□
Token-Ring	□	□	Optional	Optional	□	□
Automatic interface switching	□	□	■	■	□	□
Simultaneously active ports	□	□	■	■	■	■
Paper Handling						
Capacity of each standard input cassette	N/A	500, 250	500, 250	500, 500, 500	250, 250	250, 250
Supports B-size paper	□	□	■	■	■	■
Standard output-tray capacity (sheets)	N/A	500	500	500	250 (facedown), 250 (faceup)	250 (facedown), 250 (faceup)
Duplexing	□	■	□	□	□	□
Rated maximum paper weight (pounds)	20	35	32	32	32	32
Rated duty cycle (pages per month)	50,000	50,000	50,000	50,000	50,000	50,000
Fonts and Features						
HP PCL support	PCL 4	PCL 4	PCL 5	PCL 5	PCL 5	PCL 4
Accepts HP-compatible font cartridges	■	■	□	□	■	□
PostScript language support	None	ALPScript PDL (optional)	Adobe PostScript Level 2	Adobe PostScript Level 2	None	Adobe PostScript Level 2
Number of Type 1 fonts supported	N/A	35	35	35	N/A	39
Supports automatic emulation switching	□	□	■	■	□	□
Supports resolution enhancement	□	□	■	■	□	□
Printer-specific Microsoft Windows 3.1 driver available	□	■ (in Windows 3.1)	■ (included)	■ (included)	■ (included)	■ (included)
Number of LCD characters	16	32	32	32	32	32
Customer Support						
Toll-free technical support	■	■	■	■	■	■
Technical support hours (eastern time)	11:00–8:00 M–F	11:00–8:00 M–F	8:00–8:00 M–F	8:00–8:00 M–F	10:30–7:30 M–F	10:30–7:30 M–F
BBS	□	□	■	■	■	■
Warranty coverage (parts and labor)	1 year	1 year	1 year	1 year	1 year	1 year

* Each printer's speed when using B-size paper (for those that can print on paper this size) will usually be lower than the rating we report here N/A—Not applicable The product does not have this feature

	DEClaser 3250	Genicom Model 7170
	$4,799	$4,495
	Laser	Laser
	Fuji Xerox 4213	Toshiba G750
	13	17
	Cut-sheet	Cut-sheet
	□	■
	6,000	13,000
	10.5MB	9MB
	Standard	Proprietary
	300 x 300	300 x 300
	16-MHz Intel 80376	25-MHz National NS32GX32
	□	□
	■	■
	■	■
	□	□
	□	Optional
	Optional	Optional
	□	Optional
	□	□
	□	□
	250, 250	250, 250
	□	□
	500	350 (facedown), 500 (faceup)
	■	Optional
	32	36
	35,000	50,000
	PCL 4	PCL 5
	□	■
	Xerox PDL	GeniScript PDL (optional)
	43	35
	■ (via software)	■
	□	■
	■ (available on request)	■ (included)
	36	16
	■	■
	8:30–6:00 M–F	8:00–7:00 M–F
	□	■
	1 year	1 year

CONTINUES

the other accommodates 250 letter-, legal-, executive-, or A4-size sheets. A third standard tray handles up to 35 envelopes, and the output tray can hold 500 sheets.

Although this printer is no speed demon and no perfectionist, the LSX1600 can handle most paper-handling needs without breaking the budget. And with street prices ranging from $2,100 to $2,700, it is easily the least expensive of the network printers we tested.

ALPS America, *3553 N. First St., San Jose, CA 95134; 800-825-2577, 408-432-6000; fax, 408-432-6035.*

ALPS LSX1600 *List price: $3,295. 0MB RAM card, $285; 2MB RAM card, $535; 4MB RAM card, $715; 6MB RAM card, $995; ALPScript PostScript emulation, $695; drum, $377; developer, $495; toner cartridge, $168. Dimensions (HWD): 16.1 x 18.4 x 20 inches. Weight: 80lbs. Emulation: HP PCL 4.*
Circle 505 on reader service card

Compaq Computer Corp.

Compaq PageMarq 15
Compaq PageMarq 20

BY JOHN R. QUAIN

Making its printer debut with the 15-ppm PageMarq 15 ($3,999) and 20-ppm PageMarq 20 ($5,499), Compaq has established a new price/performance standard for shared laser printers. For just $4 more than the 17-ppm HP LaserJet IIISi in its PCL-only standard configuration, Compaq's PageMarq 20 adds Adobe PostScript Level 2 emulation, support for 11- by 17-inch paper (a B-size cassette costs $89), and more memory (4MB standard versus HP's 1MB). For almost $1,500 less, the PageMarq 15 matches the PageMarq 20 in features, but has a slightly slower engine.

Compaq PageMarq 15, Compaq PageMarq 20

The PageMarq models are based on Fuji Xerox laser engines and employ an AMD 29000 RISC processor. The PageMarq 20's controller runs at 20 MHz and comes with a 128K cache; the PageMarq 15's operates at 16 MHz. Both printers come standard with one parallel port, one serial interface, HP PCL 5, and Adobe PostScript Level 2; both will automatically switch between ports and emulations without missing a beat.

The PageMarqs' print quality is exemplary. Compaq's Print Enhancement Technology (PET) clarifies 300-dpi PCL text, smoothing the jagged curves of text and graphics, while an 800- by 400-dpi PostScript mode produces noticeably darker and sharper text. The PET feature has three print density settings (light, medium, and dark), and a 400- by 400-dpi PostScript resolution is also included.

PAGEMARQ PERFORMANCE

In both emulations using the parallel port, the PageMarq 20 posted the second-fastest Text Speed test results among the shared lasers—16.5 pages per minute in PCL 5 mode and 17.2 ppm in PostScript mode—trailing only the Kentek K30D, with an engine rated at 30 ppm. In PCL-mode graphics, however, the PageMarq 20 was the third-slowest, at 1.8 graphics pages per minute. Likewise, on PCL-mode Windows applications tests, it was the second-fastest in printing PC Labs' text document, but was slower than most in printing graphics on the CorelDRAW tests. The system pulled ahead again on the PostScript Graphics Speed test, where it scored 1.1 gppm and tied for first place with the QMS-PS 1700. Using Compaq's $569 Ethernet interface option, the unit handled 14.4 ppm and 1.3 gppm in PCL mode, and 12.8 ppm and 0.4 gppm in PostScript mode.

The 15-ppm PageMarq 15 performed equally well within its class, closely following the performance trends of its

▶ SUMMARY OF FEATURES

Products listed in alphabetical order ■ = YES □ = NO	Kentek K30D	NewGen TurboPS/1200T	OTC LaserMatrix 1000 Model 5	Printronix L1016 Continuous Form Laser Printer	QMS-PS 1700	Synergystex CF1000 Continuous Form Laser Printer
List price	$23,740	$14,995	$5,695	$8,285	$6,995	$4,995
Engine						
Engine type	LED array	Laser	Laser	Laser	Laser	Laser
Model	Kentek K30D	Copal SLB-6000	Asahi Optical FL1	Pentax PL-F0301	Canon NX	Pentax PL-F0301
Rated speed (pages per minute) *	30	12	16	16	17	16
Paper support	Cut-sheet	Cut-sheet	Continuous-form	Continuous-form	Cut-sheet	Continuous-form
Single-cartridge toner/developer/drum	□	□	□	□	■	□
Toner capacity (copies)	13,000	5,000	4,000	8,000	8,000	4,000
Total installable memory	22MB	48MB	9MB	24MB	32MB	8MB
Standard or proprietary	Standard	Proprietary	Standard	Proprietary	Standard	Standard
Maximum resolution (dpi)	300 x 300	1,200 x 600	300 x 300	300 x 300	600 x 600	300 x 300
Processor on controller	33-MHz Intel 80860	25-MHz Weitek XL-8220	20-MHz Intel 80960KB	25-MHz Motorola 68030	25-MHz Intel 80960CA	12.5-MHz Intel 80186
RISC	■	■	■	□	■	□
Interfaces						
Parallel	■	■	■	■	■	■
Serial	■	■	■	■	■	■
SCSI	□	■ (for hard disk storage only)	□	□	■ (for hard disk storage only)	□
AppleTalk	□	■	□	□	■	□
Ethernet	Optional	■	□	□	Optional	□
Token-Ring	□	□	□	□	Optional	□
Automatic interface switching	□	■	■	□	■	□
Simultaneously active ports	□	■	■	□	■	□
Paper Handling						
Capacity of each standard input cassette	550, 250	250, 250	N/A	N/A	500, 500	N/A
Supports B-size paper	□	■	□	□	□	□
Standard output-tray capacity (sheets)	550	250	N/A	N/A	500 (facedown), 100 (faceup)	N/A
Duplexing	■	□	□	□	Optional	□
Rated maximum paper weight (pounds)	24	34	40	24	36	24
Rated duty cycle (pages per month)	150,000	10,000	25,000	30,000	50,000	Info not available
Fonts and Features						
HP PCL support	PCL 5	PCL 4	PCL 5	None	PCL 4	PCL 4
Accepts HP-compatible font cartridges	□	□	■	N/A	□	■
PostScript language support	PhoenixPage PDL (optional)	NewGen PostScript PDL	None	PhoenixPage PDL (optional)	Adobe PostScript Level 1	None
Number of Type 1 fonts supported	39	35	N/A	39	45	N/A
Supports automatic emulation switching	□	■	□	□	■	□
Supports resolution enhancement	□	■	□	□	□	□
Printer-specific Microsoft Windows 3.1 driver available	□	■ (included)	□	□	■ (included)	□
Number of LCD characters	5	16	16	32	32	16
Customer Support						
Toll-free technical support	□	□	■	□	■	□
Technical support hours (eastern time)	10:00–6:00 M–F	9:30–8.00 M–F	10:00–8:00 M–F	9:00–8:00 M–F	8.00–8:00 M–F	8:30–5:30 M–F
BBS	□	■	■	□	■	□
Warranty coverage (parts and labor)	90 days	1 year	1 year	1 year, or 90 days on-site	2 years	1 year

* Each printer's speed when using B-size paper (for those that can print on paper this size) will usually be lower than the rating we report here N/A—Not applicable: The product does not have this feature

	TI microLaser XL Turbo	Toshiba PageLaser GX400
	$3,649	$4,499
	Laser	Laser
	Sharp JX9700	Toshiba G750
	16	17
	Cut-sheet	Cut-sheet
	□	■
	6,000	13,000
	10.5MB	9MB
	Proprietary	Proprietary
	300 x 300	300 x 300
	16-MHz Weitek 8220	25-MHz National NS32GX32
	■	□
	■	■
	Optional	■
	Optional (for hard disk storage only)	□
	Optional	Optional
	Optional	Optional
	□	Optional
	■	□
	■	□
	250	250, 250
	□	□
	250	350 (facedown), 100 (faceup)
	□	Optional
	34	36
	25,000	50,000
	PCL 4	PCL 5
	□	■
	Adobe PostScript Level 2	Toshiba PDL (optional)
	35	35
	■	■
	□	■
	■ (included)	■ (included)
	16	16
	□	■
	9:00–5:30 M–F	9:00–6:00 M–F
	□	■
	1 year	1 year

ENDS

faster sibling in most respects. The PageMarq 15 turned in 12.8 ppm (via the parallel connection) in both PCL and PostScript modes. On the Graphics Speed test, the PageMarq 15 delivered 1.4 gppm (PCL mode) and 1.0 gppm (PostScript mode). With the network connection, Text Speed scores in both modes were under 11 ppm; its 1.2-gppm score in PCL mode, however, was quite close to its faster sibling's.

For both printers, using the 800- by 400-dpi resolution resulted in a performance hit of approximately 50 percent in graphics tasks, as could be expected.

Aside from print speed, the only major difference between the PageMarq 20 and 15 is their paper-handling abilities. Compaq has designed a motorized paper tray that stacks and feeds 8.5- by 11-inch paper horizontally. Three of these "TwinTrays" give the PageMarq 20 a standard paper capacity of 1,500 sheets. The model 15 comes with only two cassettes: one TwinTray and one standard tray, for a total of 750 sheets in the standard configuration.

Each PageMarq has a backlit 32-character LCD panel. Virtually every parameter of the printers can be set from a flip-down control panel. At the press of a Help button, the PageMarqs will print out a menu map to assist you in navigating the printers' extensive list of options—including instructions on how to set up the optional NIC (network interface card).

All ports are active simultaneously and you can set individual priority ratings for the interfaces. Both units switch paper trays automatically.

Among the numerous options is a $399 Group III send/receive PostScript fax feature (with software), which allows the PageMarqs to communicate with standard fax machines as well as send 800- by 400-dpi faxes to other PostScript fax printers, like the 300-dpi NEC Silentwriter Model 95 reviewed in the mainstream lasers section.

If the supplied 43 scalable fonts aren't enough, a 60MB IDE hard drive option ($549) will provide plenty of room for storing more PostScript fonts and for queueing faxes.

Network managers will no doubt be attracted to Compaq's $569 Ethernet interface option. It comes in 10BaseT or thin-wire configurations and allows you to set up the PageMarqs as either remote printers or print servers on a Novell LAN. Of the network interfaces we tested, Compaq's Ethernet NIC offered some of the most sophisticated networking functions currently available.

The NIC package includes a Novell-compatible network administrator utility that informs administrators when the printer has encountered a problem. It also allows the LAN manager to change the printer and NIC setups, retrieve an error log, and obtain a list of installed options—all remotely. The NIC is field-upgradable, and a $729 Token-Ring option with source routing is also available.

Additional attractions include an extensive self-help Windows utility (standard) and optional programmable flash memory modules for PCL fonts. Compaq also includes a toner recycling program and free on-site service for one year.

With the PageMarqs, Compaq has made a powerful entrance into the printer market. The mix of price, performance, and features may well entice many corporate buyers who would otherwise be reluctant to consider a printer that lacks the HP logo.

Compaq Computer Corp., *20555 SH 249, Houston, TX 77070-2698; 800-345-1518.*

Compaq PageMarq 15 *List price: $3,999. 2MB RAM upgrade, $299; 4MB RAM upgrade, $399; 8MB RAM upgrade, $709; 16MB RAM upgrade, $1,299; 60MB IDE hard drive, $549; 500-sheet letter-size TwinTray, $109; 250-sheet letter-, A4-, legal-, or B-size paper cassette, $89 each; programmable font modules, $239 to $399; fax option, $399; AppleTalk interface, $229; Token-Ring interface, $729; Ethernet interface, $569; toner cartridge, $269. Dimensions (HWD): 16.2 x 20.5 x 21.25 inches. Weight: 65 pounds. Emulations: Adobe PostScript Level II, HP PCL 5.*

Compaq PageMarq 20 *List price: $5,499. 100-sheet multipurpose paper cassette (letter, legal, executive, folio, or envelopes), $399; other options are the same as for the Compaq PageMarq 15. Dimensions (HWD): 19.6 x 20.5 x 21.3 inches. Weight: 83 pounds. Emulations: Adobe PostScript Level 2, HP PCL 5.*

Circle 506 on reader service card

Dataproducts Corp.

Dataproducts LZR 1555
Dataproducts LZR 1560

BY ALFRED POOR

The big story on the new Dataproducts LZR 1555 and Dataproducts LZR 1560 is the paper these two can handle—and the price. Based on a new Fuji Xerox 15-ppm, 400-dpi engine, these $3,395 printers make ledger-size printing affordable.

The main differences between the two compact printers are found in their controllers (both from Dataproducts). The LZR 1555 is PCL 5- and HPGL-compatible, designed to serve double duty as a printer and a fast plotter. It can accept HP and third-party font cartridges designed for the HP LaserJet III. The LZR 1560, with Adobe PostScript Level 2, PCL 4, and parallel, serial, AppleTalk, and SCSI ports, is suitable for a printer aimed at the desktop publishing market. The LZR 1555 has one parallel and two serial ports; in both printers, all ports are active simultaneously, but you must preconfigure the emulation for each port.

Dataproducts LZR 1555, Dataproducts LZR 1560

Each printer comes in three different models. The $3,395 versions have a single 250-sheet paper bin that can accommodate, one at a time, the letter- and ledger-size paper trays that come standard with each unit. (An adjustable manual feed slot can handle both sizes of paper.) You can also order each model with two or three bins ($3,595 and $3,795, respectively) and keep letter- and ledger-size paper loaded at the same time. Each unit also comes with a 250-sheet faceup and a 250-sheet facedown output tray; again, you can only use one at a time.

PERFORMANCE DIFFERENCES

The LZR 1555 uses a 20-MHz Motorola 68020 with RISC-based ASICs, while the LZR 1560 uses a 7.25-MHz Weitek XL8200 RISC processor. Both units can print 400 by 400 dots per inch (under the HPGL emulation for the LZR 1555 and under PostScript for the LZR 1560).

The differences in controllers show up in the performance figures. Both models produced similar PCL-mode Text Speed test scores—the PCL-oriented LZR 1555 produced 12.5 pages per minute, while the LZR 1560 was slightly slower at 12.3 ppm—but the difference in PCL graphics was considerable. The LZR 1555 produced a respectable 2.1 graphics pages per minute, while the LZR 1560 managed just 0.8 gppm.

As a printer geared towards the desktop publishing market, you'd expect the LZR 1560 to perform better in PostScript mode, and it does. On our PostScript-mode Text Speed test, it scored 13.1 ppm, the faster of the two 15-ppm PostScript-equipped printers we looked at. Its 0.6-gppm PostScript-mode Graphics Speed test score was second to the 15-ppm Compaq PageMarq 15 (when tested via its parallel port), but ahead of some printers with faster engines and PostScript options.

Output for both the LZR 1555 and LZR 1560 showed smooth halftones and solid blacks. Though the systems lack any Resolution Enhancement Technology, jaggies were not a serious problem.

Each printer comes with 4MB of memory, expandable to 16MB with standard ZIP RAM. A $399 multimedia feeder handles 100 sheets, 15 envelopes, or 50 postcards. Distributors determine the street prices and availability of third-party on-site service.

Both units have easy-to-use front control panels that are hidden in a wedge-shaped unit that flips out from the printer. The 32-character LCD window is backlit, and you can print out a report showing the configuration menu choices—a handy feature for those times when the printer manual has disappeared.

If you are looking for ledger-paper printing at a bargain-basement price, either of these two Dataproducts printers is well worth consideration.

Dataproducts Corp., *6219 De Soto Ave., P.O. Box 746, Woodland Hills, CA 91365; 800-334-3174, 818-887-8000; fax, 818-887-4789.*

Dataproducts LZR 1555 *List price: $3,395 (single bin); $3,595 (double bin); $3,795 (triple bin). 4MB RAM upgrade, $499; 250-sheet letter-, legal-, executive-, A4-, or B-size paper cassette, $89 each; multimedia feeder (15 envelopes, 50 postcards, or 100 letter-size sheets), $399; XP1 Ethernet external box (TCP/IP or LAT), $995; fuser, $229; toner cartridge, $279. Dimensions (HWD): 12.0 x 20.5 x 25.7 inches. Weight: 69 pounds. Emulations: HP PCL 5, HPGL.*

Dataproducts LZR 1560 *List price: $3,395 (single bin); $3,595 (double bin); $3,795 (triple bin). 0MB RAM upgrade, $99; 4MB RAM upgrade, $399; other options are the same as for the Dataproducts LZR 1555. Dimensions (HWD): 12.0 x 20.5 x 25.7 inches. Weight: 69 pounds. Emulations: Adobe PostScript Level 2, HP PCL 4.*

Circle 507 on reader service card

Digital Equipment Corp.

DEClaser 3250

BY JOHN R. QUAIN

You don't have to be a Digital VMS user to appreciate the abilities of Digital Equipment's DEClaser 3250 ($4,799). This 13-ppm printer includes enough emulations and features to satisfy a variety of PC users in a shared environment.

Based on a Xerox laser engine and a 16-MHz Intel 80376 processor and 80387SX coprocessor, the DEClaser includes 7MB of standard SIMMs (expandable to 10.5MB), a Centronics parallel port, and a serial (MMJ) port, which can be used to hook up to a Digital server. The printer also includes Xerox's PostScript Level 1 interpreter, HP PCL 4, and Digital's PPL3 emulation, which is LNO3-compliant. Two cartridge slots on the front accept additional Digital font options or standard PostScript font options. The unit switches emulations

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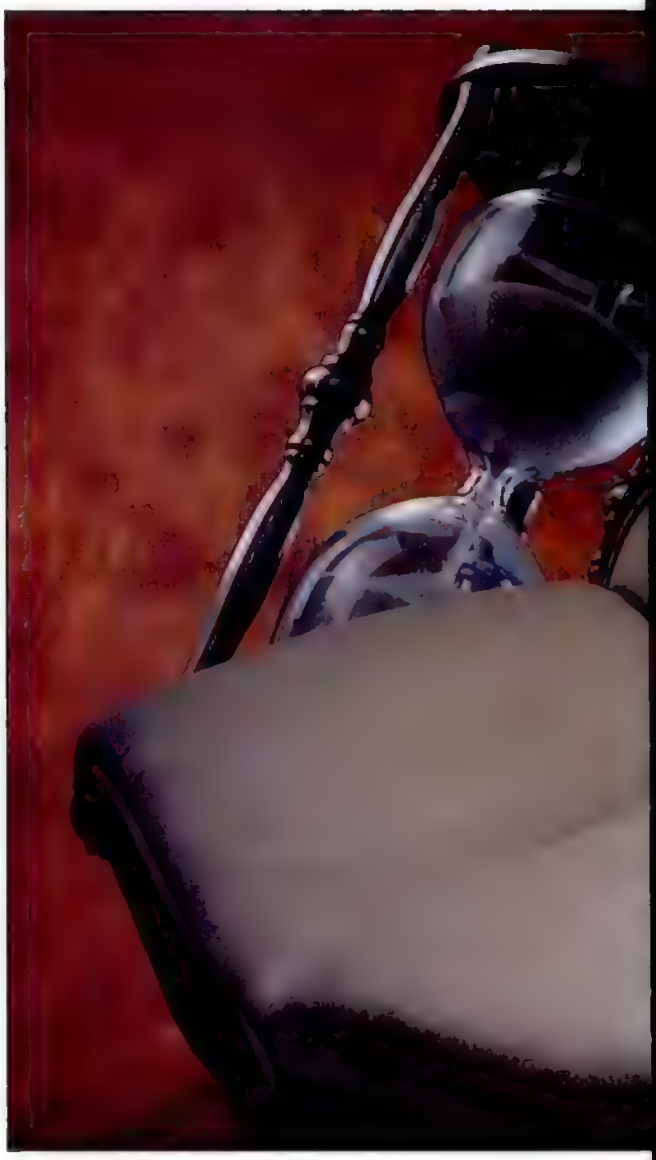

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† Specifications for all Leader systems except 386/SX-25 and 486/25 which have 2MB RAM expandable to 16MB, 16-bit SVGA-512K, 3 expansion slots, non-upgradable processor.

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through software. (If you don't need PostScript, the $3,599 DEClaser 3200 is the same 13-ppm printer without the PostScript option.)

The extensive array of controls and indicators includes a clearly legible backlit LCD. A diagram of the printer illuminates component parts when they need to be replaced or when a door has been left ajar.

You'll also find a number of practical features, such as jam recovery, so that you won't lose a sheet in the middle of a 50-page document due to a misfeed. The unit will switch trays on command and supports duplexing. The latter can be set for standard bindings or adjusted for top binding, such as that used in legal documents.

Countering these pluses is the DEClaser's three-part consumable system. Replacing the toner assembly involves a tricky maneuver, and users who refuse to read instructions are liable to end up with toner in their shoes.

On our PCL-mode Text Speed test, the DEClaser produced 14.1 pages per minute, exceeding its engine's 13-ppm rating. Its speed on our graphics test was a rather spritely 3.4 graphics pages per minute—third-fastest among the shared laser printers. In PostScript mode, the DEClaser scored 10.9 ppm and 0.4 gppm, beating only the 12-ppm NewGen TurboPS/1200T.

The system produced solid 300-dpi output, with letters and images of sufficient darkness and uniformity. Paper is supplied via two 250-sheet letter-size cassettes in the standard configuration. Cassette options include a 1,500-sheet letter-size cassette ($749) and a multimedia cassette that can accommodate 75 labels or envelopes, as well as letter-size paper and transparencies, in up to 32-pound stock.

OF TWO WORLDS

Users already ensconced in a VMS world will appreciate several specific features, including DEC Print software. Using the printer's MMJ serial connector and the supplied 10-foot cable, the layered VMS utility includes features for duplexing control and sending status messages. If you're not living in a Digital mainframe world, a 10BaseT and 10Base2 Novell Ethernet adapter is available for $584, though we didn't see these options for testing.

Digital offers a wide assortment of service options to fit nearly any corporate requirement. Don't expect to see many dealer discounts, however, since Digital now sells this printer through its own direct market channel as well as through dealers.

If you're looking for a printer to handle a mixed Digital and PC environment, the DEClaser 3250 offers numerous emulations and features at acceptable speeds.

Digital Equipment Corp., *146 Main St., Maynard, MA 01754-2571; 800-344-4825; fax, 800-234-2298.*

DEClaser 3250 *List price: $4,799. 2MB RAM upgrade, $349; additional font cartridges, $299 each; additional font software, $163 each; 250-sheet letter-, legal-, or A4-size paper cassette, $79 each; 1,500-sheet letter- or A4-size paper cassette, $749 each; multimedia cassette (envelopes, labels, transparencies, letter-size paper), $99; Ethernet interface (Novell), $584; Ethernet interface (LAT) $449; Centronics parallel cable, $19; printer table, $279; drum, $150; developer, $183; toner cartridge, $83. Dimensions (HWD): 19.1 x 21.0 x 19.7 inches. Weight: 85 pounds. Emulations: DEC PPL3, HP PCL 4, Xerox PostScript Level 1 interpreter.*
Circle 508 on reader service card

Genicom Corp.

Genicom Model 7170

Toshiba America Information Systems Inc.

Toshiba PageLaser GX400

BY ALFRED POOR

Genicom Corp. and Toshiba America Information Systems worked together to develop these two 17-ppm printers, which explains their peas-in-a-pod appearance. The Genicom Model 7170 carries a list price of $4,495, while the Toshiba GX400 comes in at $4,499—and that $4 is about the only difference between the two.

These printers are based on the Toshiba G750 print engine, with print resolution of 300 dots per inch and a feature Toshiba calls Print Quality Enhancement (similar to HP's RET). The base units are fairly compact for network printers: 13.2 by 30.2 by 18.3 inches and 62 pounds. This includes two 250-sheet paper trays (which fit flush inside the case) for letter-, legal-, and A4-size paper. The paper can be routed to a 350-sheet facedown bin that's on both printers, or a 500-sheet faceup tray (on the Genicom) or 100-sheet faceup tray (on the Toshiba). Note that these faceup trays are physically identical, despite the difference in the manufacturer's specifications.

BUILD YOUR PERFECT PRINTER

A long list of paper-handling options makes it easy to create your own print shop in a tower. The added layers stack together like giant Lego blocks, adding little to each printer's footprint. A duplexing option costs $695 from Genicom or $699 from Toshiba; a multimedia feeder holds labels, transparencies, or 100 envelopes ($495 from Genicom, $499 from Toshiba).

If you need to print long reports, you can get a 1,500-sheet input bin for letter- or legal-size paper ($895 from Genicom, $899 from Toshiba). A 1,500-sheet output bin option costs $895 from Genicom, and the requisite $4 more from Toshiba. The remaining option for the stack is a ten-bin collator that allows you to print ten copies of a report at a time without hand-sorting the pages ($2,495 from Genicom and—you guessed it—$2,499 from Toshiba). On these printers you can install either the large-capacity output bin or the collator unit, but not both at the same time.

The front panel is easy to use, with its 16-character LCD message window. You can quickly configure the printer to make maximum use of all the installed options, such as feeding paper from the second internal tray for a duplex print job that will be sorted in the collator at the end.

The controller uses a 25-MHz National Semiconductor NS32GX32 32-bit

processor, backed up by a pair of ASICs. Both printers come with a HP PCL 5 (LaserJet IIISi) emulation and an IBM Proprinter XL24E mode. Both companies also offer their own PostScript-compatible interpreters as options: GeniScript and Toshiba PDL (each includes an AppleTalk interface). The test unit from Toshiba came with the $999 PostScript option installed; Genicom's $895 version was not ready in time for testing, but was available by press time.

Both printers come with parallel and serial ports, but only one is active at a time. After you add the optional PostScript emulation, the units will switch emulations automatically.

PERFORMANCE

As you might have expected, the two sibling printers performed nearly identically via the parallel port on our performance tests. The Genicom unit turned out 14.7 pages per minute on our PCL-mode Text Speed test, while the Toshiba showed 14.8 ppm. On the PCL-mode Graphics Speed trial, the Genicom produced 3.2 graphics pages per minute; the Toshiba delivered 3.3 gppm. The Toshiba's PostScript option scored a respectable 14.7 ppm for text, but only 0.4 gppm for graphics—one of the slowest PostScript graphics scores (using the parallel port) for this group. The output for both printers had dark blacks and even fills.

Each unit comes with 1MB of RAM, expandable up to 9MB total by proprietary SIMMs. Network options for both printers—only a NIC for Genicom arrived for testing—include NetWare over 10BaseT ($695 from Genicom, $699 from Toshiba) and NetWare over Token Ring ($995 and $899, respectively). On PCL network tests, the Genicom managed 11.7 ppm and 1.8 gppm.

Both companies offer 12 months of on-site service; Genicom lets you extend this for a second year for $528, while Toshiba's service contracts are negotiated through the dealer.

If you need to print lots of PCL-mode output and you want maximum paper-handling options with a minimum of bother, either of these printers can give you a wide choice with decent performance.

Genicom Corp., *One Genicom Dr., Waynesboro, VA 22980; 800-443-6426, 703-949-1000; fax, 703-949-1392.*

Genicom Model 7170 *List Price: $4,495. 1MB RAM upgrade, $225; 2MB RAM upgrade, $345; 4MB RAM upgrade, $495; 1500-sheet letter- or legal-size paper cassette, $895 each; multimedia paper cassette (labels, transparencies, envelopes), $495; duplex option, $695; collator, $2,495; GeniScript PostScript interpreter, $895; Token-Ring interface (NetWare), $995; Ethernet interface (NetWare), $695; TCPIP interface, $1095; IBM coax option, $975; IBM twinax option, $975; toner cartridge, $275. Dimensions (HWD): 13.2 x 30.2 x 18.3 inches. Weight: 62 pounds. Emulations: HP PCL 5, IBM Proprinter.*
Circle 509 on reader service card

Genicom Model 7170, Toshiba PageLaser GX400

Toshiba America Information Systems Inc., *Electronic Imaging Division, 9740 Irvine Blvd., Irvine, CA 92718; 800-468-6744.*

Toshiba PageLaser GX400 *List price: $4,499. 1MB RAM upgrade, $169; 2MB RAM upgrade, $299; 4MB RAM upgrade, $499; 1500-sheet letter- or legal-size paper cassette, $899 each; multimedia paper cassette (labels, transparencies, envelopes), $499; duplex option, $699; collator, $2,499; Toshiba PDL PostScript interpreter, $999; Token-Ring interface (Novell), $899; Ethernet interface (Novell), $699; toner cartridge, $289. Dimensions (HWD): 13.2 x 30.2 x 18.3 inches. Weight: 62 pounds. Emulations: HP PCL 5, IBM Proprinter.*
Circle 510 on reader service card

Kentek Information Systems Inc.

Kentek K30D

BY JOHN R. QUAIN

Kentek Information Systems' K30D is not a printer to be taken lightly. Weighing in at 161 pounds, the K30D's imposing size (16.5 by 48 by 19 inches), $21,430 price in its standard configuration, and 30-ppm engine make it the heaviest printer in this review and the most expensive and fastest printer in this issue.

For the five-figure price, you get built-in duplexing, 300-dpi HP PCL 5 emulation, and LN03+ emulation, which is handy for those working in mainframe environments. Connections include a Centronics parallel port and RS-232C and RS-422 serial ports. The basic model is founded on a Motorola 68020 controller with 10MB of memory and comes with two 1.44MB floppy disk drives.

With a 33-MHz Intel i860 RISC controller in place of the Motorola chip, the product's price climbs to $23,740. Our test unit included that, plus a 52MB IDE hard disk ($995) in place of one floppy disk drive and PhoenixPage PostScript Level 1 emulation ($695). This brought the model up to a staggering $25,439—unless you need a heavy-duty duplexing printer with a rated duty cycle of 150,000 pages a month.

PostScript and PCL 5 emulations are loaded from disks and remain resident on the printer's hard disk, leaving about 46MB of disk space free to store customized forms and additional fonts. Kentek plans to offer an 80MB hard disk for the same price as the 52MB hard disk this fall. The printer accepts up to 22MB of RAM (or 18MB total with the Motorola chip) at $850 per 4MB.

On our PCL 5–mode Text Speed test, the K30D cranked out 27.0 pages per minute, beating the second-place Compaq PageMarq 20 by more than 10 ppm. The K30D also led in the PCL-mode graphics test, with 5.5 graphics pages per minute. Windows applications test speeds were ahead of the rest by a similar margin.

Using the machine's PostScript Level 1 emulation option, its Text Speed test output was 26.9 ppm, but output on our Graphics Speed test dropped to 0.2

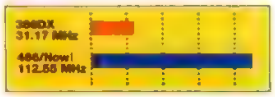
A PC Is A Terrible Thing To Waste.

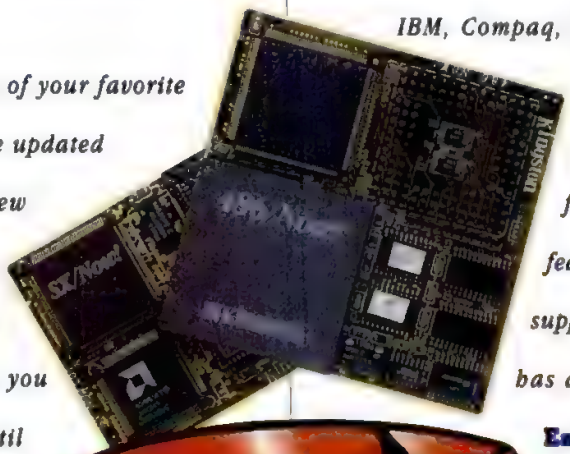
IBM PS/2 Models 70 & 80 and Compaq Deskpro 386 systems have a future with 486/Now! processor upgrades.

Every year or so, a new version of your favorite software comes out. Ideally, the updated version is easier to use, has new features and hopefully makes you more efficient. To get the most from these improvements, you need 486 processing power. Until now, your only solution was to buy a whole new system. In addition to the cost, this meant re-installing software and buying new peripherals.

Don't Replace the System – Simply Upgrade the Processor.

A better alternative is to upgrade only the processor. 486/Now! from Kingston is a great way to get the processing power you need for business applications, network file servers, graphics programs and CAD/CAM. 486/Now! is available with either a 486DX 33MHz or a 486SX 25MHz, and has an on-board clock for optimum processor performance.





The Solution For 286 Systems.

SX/Now! is a great way to upgrade 286 systems from IBM, Compaq, AST, HP, Epson, NEC, Toshiba and Zenith to a Windows and OS/2 ready Am386SX, the fastest 386SX available. SX/Now! features 16kb of fast cache memory, supports a 387SX co-processor and has an on-board clock.

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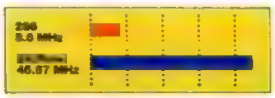
Kingston processor upgrades plug directly into the system board, won't interfere with bus slots and take only about ten minutes to install. They're guaranteed fully compatible with both the systems for which they were designed, plus all popular operating systems and applications. 486/Now! and SX/Now! carry five-year warranties. For the power you need and the reliability you expect, call Kingston at (800) 835-6575 for more information or the name of a reseller near you.



Comparison of native Compaq Deskpro 386/20e and same system with 486/Now! 486DX-33MHz Landmark Speed Test 2.02. Comparison of native IBM PS/2 Model 50 and same system with SX/Now! 386SX-33MHz Landmark Speed Test 2.03. All trademarks are of their respective owners.

Kingston TECHNOLOGY CORPORATION

THE INSIDE NAME IN UPGRADES

17600 Newhope Street, Fountain Valley, California 92708 (714) 435-2600 Fax (714) 435-2699

CIRCLE 106 ON READER SERVICE CARD

gppm—the slowest of the group.

The K30D is based on a Kentek-designed LED array print engine, and its typefaces and print quality on halftone images matched those of most of the others in this group.

SETUP AND OPERATION

Setting up the K30D is not as daunting as you might assume from the list of features and price. It uses a three-part consumable arrangement with separate components for fuser, developer, and toner, plus cleaner. Anyone who can pop open the office photocopier shouldn't encounter any difficulty here.

The most trying aspect of operating the K30D is its control panel. The membrane keys serve multiple functions, buttons must be pushed in odd sequences, and inscrutable codes rather than plain-English messages are displayed on the LCD panel. The K30D will print out configuration status pages when you get lost, but making changes requires patience. Once mastered, the control panel allows selection of a variety of options, including duplexing and emulations.

The printer will automatically switch to its second paper cassette when the first

is empty. Together, the two multipurpose cassettes accommodate up to 800 sheets of letter-, legal-, executive-, A4-, or B5-size paper. Network users will appreciate the jam recovery feature.

Kentek's $1,295 Ethernet TCP/IP option hooks easily onto the back of the printer with three cable connections; to install the software you'll have to contend with the printer's hermetic messages.

The breadth and performance of the K30D is impressive. If you need high-speed duplex printing but don't need 11- by 17-inch stock, and you've got the budget, this may be the model your company is looking for.

Kentek Information Systems Inc., *2945 Wilderness Pl., Boulder, CO 80301; 303-440-5500; fax, 303-440-9600.*

Kentek K30D *List Price: $21,430 with Motorola processor; $23,740 with RISC option. 4MB RAM upgrade, $850; 52MB SCSI hard disk, $995; PhoenixPage PostScript Level 1 emulation, $695; 1,200-sheet high-capacity feeder, $1,495; envelope cassette, $380 (with fuser, $1,295); 1,400-sheet output tray, $1,495; Ethernet (TCP/IP) interface, $1,295; printer cabinet, $450; drum, $359; developer, $997; toner cartridge (two-pack), $98. Dimensions (HWD): 16.5 x 48.0 x 19.0 inches. Weight: 161 pounds. Emulations: DEC LNO3+, HP PCL 5.*

Circle 534 on reader service card

NewGen Systems Corp.

NewGen TurboPS/1200T

BY ALFRED POOR

With a list price of $14,995, you might expect more from the desktop-size NewGen TurboPS/1200T than its 12-ppm engine, single 250-sheet paper bin, and lone face-up output tray. And you'd get more: This printer also features the ability to handle 11- by 17-inch paper, 1,200- by 600-dpi output, HPGL emulation, and on-site installation.

The TurboPS/1200T is based on a Copal SLB-6000 print engine, which is more similar to an office photocopier engine than a personal laser printer engine. Since a number of the installation steps can get tricky and careless handling can ruin the print drum or make a mess with the toner or developer, a technician comes to your site and performs the initial installation and setup, free of charge. The added benefit of this process is that the technician can tune the printer so that you get top-quality output right from the start.

After the initial setup, you install your own toner and perform basic maintenance like clearing paper jams, but the warranty provides on-site service for the first year. (You can extend this for three additional years for $1,995.) Per-page print costs, however, come out to a rather high 7 cents.

The controller is based on a 25-MHz Weitek RISC processor, and it provides PCL 4 and NewGen's PostScript Level 1 interpreter. The printer automatically switches among interfaces and emulations.

During testing, the TurboPS/1200T failed our PCL-mode Torture Test, though its incompatibilities were minor compared with those of some of its siblings (reviewed in the mainstream laser section). According to a NewGen representative, the PCL mode is a secondary feature for the printer, and the company expects PostScript to be used most often.

The 12-ppm (with letter-size paper) TurboPS/1200T had the lowest speed rating of the network laser group. Its performance figures were correspondingly slow. In PCL mode it was slower, in fact, than some of the 10-ppm printers reviewed in the mainstream lasers section: 9.0 pages per minute on the Text Speed test and just 0.2 graphics pages per minute on the Graphics Speed test. Like many of its siblings, its PCL-mode Windows applications performance was also poor: The TurboPS/1200T had some of the slowest scores we saw. In 300-dpi PostScript mode, it fared slightly better: 9.6 ppm and 0.7 gppm.

Using NewGen's Image Enhancement Technology (IET), the TurboPS/1200T produced fine-quality output, with smooth edges.

The unit comes with 20MB of RAM; you can add up to 48MB. The printer comes with two paper trays standard, one for letter- and one for ledger-size paper. If you want to keep both loaded at the same time, you'll have to purchase a second paper tray assembly ($1,495). You get Ethernet TCP/IP and AppleTalk interfaces standard, though full NetWare support was not available in the unit we tested.

Although the TurboPS/1200T is not the swiftest candidate in this review, its ability to handle ledger-size paper is attractive. But with prices falling in the B-size laser printer category, the inclusion of a high-resolution 12-ppm engine helps to justify the rather high price. At about $11,000 on the street, the TurboPS/1200T may be right for your desktop publishing needs, but investigate other options before you make a decision.

NewGen Systems Corp., *17580 Newhope St., Fountain Valley, CA 92708; 800-*

756-0556; 714-641-8600; fax, 714-641-2800.

NewGen TurboPS/1200T *List Price: $14,995. 1MB RAM upgrade, $89; 2MB RAM upgrade, $169; 4MB RAM upgrade, $329; 8MB RAM upgrade, $649; 250-sheet letter-, legal-, or B-size paper cassette, $259; second paper tray assembly, $1,495; 500-sheet output tray, $749;*

drum, $549; toner cartridges (three-pack), $249; SCSI cables, $59 to $69. Dimensions (HWD): 15.5 x 44.0 x 22.5 inches. Weight: 118 pounds. Emulations: HPGL, HP PCL 4, NewGen PostScript Level 1 interpreter.

Circle 535 on reader service card

Output Technology Corp.

OTC LaserMatrix 1000 Model 5

BY ANGELA GUNN

If you need printing power for tractor-feed forms, the $5,695 LaserMatrix 1000 Model 5 from Output Technology Corp. deserves a spot on your shopping list.

The LaserMatrix uses a 20-MHz Intel 80960KB RISC processor on a controller of Output's own design, and the Asahi Optical FL1000 engine. (The other continuous-form laser printers in this review are based on the very similar Pentax engine.) The 16-ppm LaserMatrix can be hooked to the network through either its parallel or serial port, or you can use the slot in the back, which supports the $695 ExtendNet network interface card from Extended Systems. The printer switches automatically between interfaces.

The LaserMatrix 1000 Model 5 comes with PCL 5 emulation; by the time you read this, Model 6 will be available ($6,295) with the Microsoft TrueImage PostScript interpreter and 2MB of RAM standard. The Model 5 accepts LaserJet Series II and III font cartridges as well as Output and PDP cartridges. A QMS Magnum Code V.1 translator costs $1,599; a bar-code font cartridge is available from the company for $249.

FORM CONTROL

The paper carriage mechanism is strictly tractor-feed, using an internal pull tractor. Front-panel controls allow users to adjust for forms from 1 to 33 inches long and from 3.5 to 8 inches wide. Like most of the continuous-form lasers, the unit provides automatic error compensation for "form drift" while printing; print accuracy is held within two scan lines per 11-inch page. The printer handles stock up to 40 pounds.

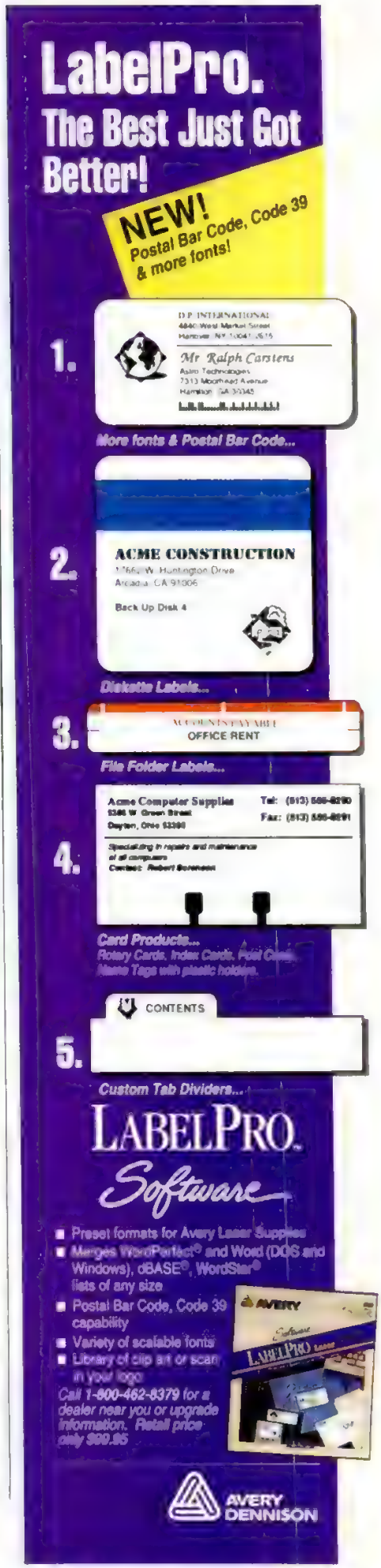
The printer doesn't automatically form-feed through and waste a blank sheet of paper at the end of a print job. The control panel allows you to delay form ejection up to 60 seconds (thus letting the sheet inside the printer from the last job be used for the next, fast-approaching job), or to opt not to eject the form at all (thus saving it for the next job, whenever it comes).

The front-panel controls also allow you to adjust fuser temperature for differently coated stock or different media (such as vinyl or card stock); this controls the temperature at which the ink melts and is pressed onto the paper. Using the least possible heat for a given paper stock is important for continuous-form lasers, because of the potential problems of heat buildup that exist when paper is in the fuser for extended periods.

On PC Labs' PCL-mode Text Speed test, the LaserMatrix was just a little slower than most of its 16-ppm competitors, managing 14.1 pages per minute. But in our PCL-mode Graphics Speed test, its 3.4 graphics pages per minute overtook them all. Output quality was sharp, with smooth gray scales.

The LaserMatrix has no paper bins; it feeds its pages in one side and straight out the other. For optimum setup, consider the $231 paper stand (a label stand costs $195). The unit ships with 1MB of memory; this can be expanded to 9MB total via IBM or Toshiba SIMMs.

The LaserMatrix is sold through distributors only; expect to find a street price somewhere around $4,000 to $4,200. The



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Kodak Diconix 701 printer

CIRCLE 362 ON READER SERVICE CARD

hardworking LaserMatrix is a good niche product, offering considerable control over the printing of forms. So feed it your worst drone jobs: This printer is ready.

Output Technology Corp., *2310 N. Fancher Rd., Spokane, WA 99212-1381; 800-468-8788, 509-536-0468; fax, 509-533-1280.*

OTC LaserMatrix 1000 Model 5

OTC LaserMatrix 1000 Model 5

List price: $5,695. Paper stand, $231; label stand, $195; QMS Magnum Code V.1 translator, $1,599; bar-code font cartridge, $249; external coax or twinax interface, $1,295; drum, $311; developer, $338; toner cartridge, $59. Dimensions (HWD): 7.3 x 18.0 x 20.5 inches. Weight: 43 pounds. Emulations: HP PCL 5.

Circle 536 on reader service card

Printronix Inc.

Printronix L1016 Continuous Form Laser Printer

BY JOHN R. QUAIN

Resting on four casters and wrapped in a 34-inch-high full-metal cabinet, the 300-dpi Printronix L1016 Continuous Form Laser Printer is armed and ready to take on a variety of label- and form-printing duties. The 16-ppm L1016 lists for $6,995, but to gain PostScript compatibility you'll need to add a second floppy disk drive ($295) and the PostScript option ($995)—for a grand total of $8,285. The L1016 is considerably more expensive than the other 16-ppm continuous-form laser printers we tested, but it is also more solidly constructed.

A swing-out front door on the L1016's cabinet reveals the 1.44MB floppy disk drive (or drives), as well as storage space for additional fanfold paper and the printer's three-part consumables. Like other continuous-form lasers in this issue, the L1016 is constructed around the top-loading, straight-paper-path Pentax PL-F0301 engine. The rest of the suit is different.

The L1016 comes with a 25-MHz Motorola 68030 processor, 8MB of memory, serial and Centronix parallel ports, a passive paper stacker to keep forms off the floor, and three impact printer emulations (IBM Proprinter, Printronix P-series, and an Epson-compatible emulation). In addition to Courier and Letter Gothic typefaces, OCR-A and OCR-B fonts are included. You can upgrade the RAM to 24MB total ($495 per 4MB) and add an RS-422 serial port or a Dataproducts parallel port ($49 for either).

Unlike the other continuous-form contenders, the L1016 does not support HP PCL emulation. Furthermore, the printer does not retain emulations in ROM. To switch between impact printing and the optional PostScript mode, you have to make a trip to the printer and switch disks.

The unit we tested included the $995 PhoenixPage PostScript Level 1 emulation, with 14 Bitstream typefaces. The L1016 produced a respectable 14.8 pages per minute on our Text Speed test and a slightly slow 0.6 graphics pages per minute on our Graphics Speed test. Print quality was quite good for a continuous-form model. Typefaces were dark, without blurring 6-point fonts.

The L1016 offers four arrow buttons to assist in selecting options; these enable you to move forward, backward, up, or down within the menus. Configurations can be loaded or deleted from the printer's disks, and you can select fonts,

Printronix L1016 Continuous Form Laser Printer

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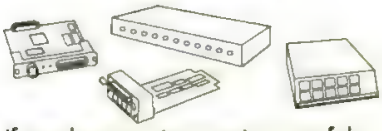

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emulations, and ports and turn off the panel's warning beeps all from the control panel. Paper widths can be set from half an inch to 8 inches, and form length can be adjusted in ⅛-, ⅙-, or ½-inch increments from 1 inch to 24 inches. The printer handles paper stock up to 24 pounds and allows you to adjust the fuser temperature.

Archivists will appreciate an unusual feature Printronix calls *page windowing*. This lets you automatically reduce a page image size to print up to four pages on one 8.25- by 11-inch form.

Like the other continuous-form laser printers we tested, the L1016 lacks the serious networking options and features one might expect at this price point. If you need heavy-duty printing of bar codes and labels, however, the sturdy L1016 unit is well prepared.

Printronix Inc., *17500 Cartwright Rd., P.O. Box 19559, Irvine, CA 92713; 800-826-3874, 714-863-1900; fax, 714-660-8682.*

Printronix L1016 Continuous Form Laser Printer *List price: $6,995; with PhoenixPage PostScript Level 1 interpreter ($995) and second 3.5-inch floppy disk drive ($295), $8,285. 4MB RAM upgrade, $495; parallel or serial adapter, $49; coax or twinax option, $1,495; Magnum IGP or Printronix IGP board, $495; drum, $214; developer, $279; toner cartridge, $118. Dimensions (HWD): 34.0 by 20.0 by 20.0 inches. Weight: 130 pounds. Emulations: Epson, IBM Proprinter, Printronix P-Series.*

Circle 537 on reader service card

QMS Inc.

QMS-PS 1700

BY ALFRED POOR

The 17-ppm QMS-PS 1700 ($6,995) makes its mark by mixing competitive price and performance with a strong range of features, including Adobe PostScript Level 1 (and 45 fonts), HPGL, automatic emulation sensing, and 600-dpi output. The solid list of options includes a $250 administrator security card that prevents users from changing the printer's elaborate network configuration settings.

The QMS-PS 1700 uses the same Canon NX print engine made famous by the HP LaserJet IIISi. Unlike its LaserJet competitor, however, this printer offers only HP PCL 4 compatibility, not PCL 5. But the QMS-PS 1700 matches the LaserJet IIISi's optional PostScript and adds 600-dpi resolution, by way of QMS's MultiRes technology.

The QMS-PS 1700's controller has an Intel 80960 CA RISC processor running at 25 MHz. The printer comes with 8MB of memory and supports up to 32MB of standard SIMMs. Optional internal and external SCSI hard disks allow for additional storage, such as a 120MB internal hard disk ($1,195). The basic model comes with serial and parallel ports and a standard AppleTalk connection.

On our performance tests, the QMS-PS 1700 printed text (using the parallel port) at 14.7 pages per minute in PCL mode and 14.4 ppm under PostScript. On the PCL-mode Graphics Speed test (with parallel port), the QMS-PS 1700 was a little slow for its class, managing 2.1 graphics pages per minute. But with a 300-dpi PostScript graphics score of 1.1 gppm, the QMS-PS 1700 tied the 20-ppm Compaq system for first place among the reviewed products (using the parallel port).

QMS offers a variety of optional network interfaces for the printer, including Ethernet for NetWare ($895) and Token-Ring for NetWare ($1,095). On our Text Speed test over Ethernet, it managed 13.1 ppm in PCL mode and 11.6 ppm under PostScript. The company also has an optional LN03 Plus emulation ($495) for users who want to attach the printer to a DECnet installation. You can configure and monitor the network interface (and the printer's other settings) using the front-panel controls and the LCD message window of two 16-character lines.

Output quality was solid, particularly with the 600-dpi resolution under Post-

Script. Blacks were dark and halftones were smooth.

The printer's paper-handling options are the same as on the LaserJet IIISi: two 500-sheet letter-size input trays, a 500-sheet facedown output tray, and a 100-sheet faceup output tray. A $695 duplex printing option installs easily.

The QMS-PS 1700 does a solid job, particularly for PostScript graphics, at a reasonable price. It also has a respectable list of features and options, including standard front and back power switches and an extended two-year on-site service contract for $1,200. If you are looking for a good printer for a number of users, this is a strong candidate to consider.

QMS Inc., *One Magnum Pass, P.O. Box 81250, Mobile, AL 36689-1250; 800-631-2692, 205-639-4400; fax, 205-633-0116.*

QMS-PS 1700 *List price: $6,995. 1MB RAM upgrade, $149; 4MB RAM upgrade, $459; 8MB RAM upgrade, $799; internal SCSI hard disks: 40MB, $795; 120MB, $1,195; external SCSI hard disks: 20MB, $795; 45MB, $1195; administrator security card, $250; 500 sheet letter-, legal-, executive-, or A4-size paper cassette, $129; envelope cassette, $495; duplex option, $695; LN03+ emulation, $495; Ethernet interface (NetWare), $895; Ethernet interface (TCP/IP), $1,845; Token-Ring interface, $1,095; DECnet Ethernet interface, $1,395; toner cartridge, $179. Dimensions (HWD): 19.2 x 17.8 x 39.5 inches. Weight: 100 pounds. Emulations: Adobe PostScript Level 1, CCITT Group 4, HPGL, HP PCL 4.*
Circle 538 on reader service card

Texas Instruments Inc.

TI microLaser XL Turbo

BY JOHN R. QUAIN

Tired of waiting for your workgroup's single laser printer to free up, but don't think you have the funds to purchase a second shared laser? Texas Instruments' 16-ppm TI microLaser XL Turbo ($3,649) may be the answer to your department's printing needs.

Intended for workgroups of up to 12 users, this low-cost alternative to burlier network lasers comes standard with HP PCL 4 and Adobe PostScript Level 2 emulations, a Centronics parallel port, and automatic emulation sensing. If you buy the $35 serial interface, the XL Turbo will also automatically switch between ports. Expect street prices in the $3,000 range, and expect decent speed.

The XL Turbo is based on a Sharp JX9700 laser engine and 16-MHz Weitek 8220 RISC controller, similar to those used in TI's 9-ppm microLaser Turbo ($1,749; reviewed in the mainstream lasers section). As with that unit, you can upgrade to the XL Turbo from any of TI's 16-ppm printers, starting with the basic microLaser XL ($2,399). The XL version is about 3 inches wider and deeper than the 9-ppm model and is intended for heavier loads: 25,000 pages per month for the XL Turbo versus 10,000 pages a month for the Turbo.

On PC Labs' tests, the XL Turbo turned in acceptable PCL-mode results for the network laser group: 14.5 pages per minute for text and 2.3 gppm. One

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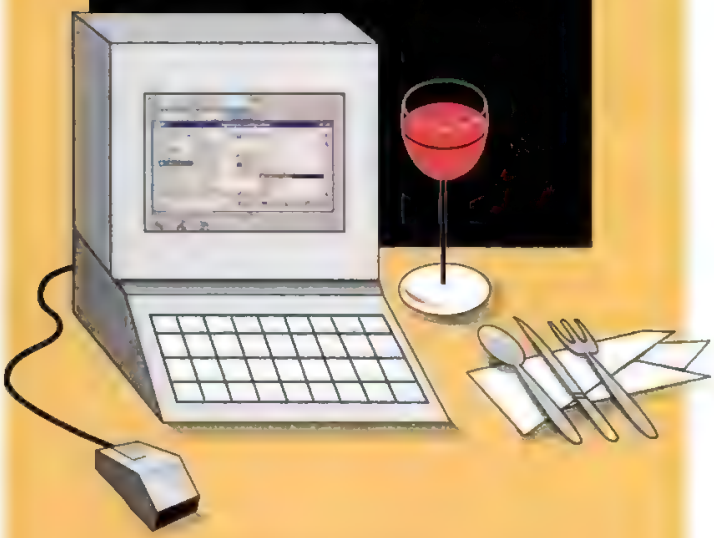

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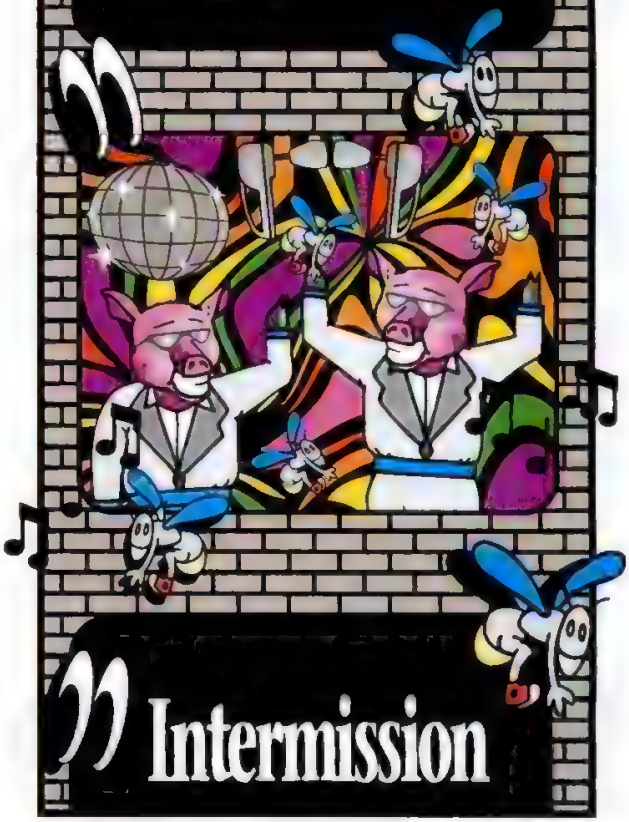

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of only four true Adobe PostScript Level 2 network laser printers we tested, the XL Turbo tied for third among the shared lasers on the PostScript-mode Text Speed test (14.8 ppm); its Graphics Speed test output was 0.9 gppm. The printer's 300-dpi print resolution isn't the finest available, but even without a text-smoothing enhancement, its text and image quality is a match for most of the printers in its class. Unless you have a yearning for 600-dpi graphics, the XL Turbo's performance will please those of you with hefty text-printing needs.

The XL Turbo comes standard with 2.5MB of memory, 2MB of which is devoted to PostScript. The unit supports a maximum of 6MB of PostScript memory ($109 for 1MB) and up to 4.5MB of PCL memory ($89 per megabyte). In case you need additional emulations, the XL Turbo accommodates two credit-card size cartridges; Diablo, IBM Proprinter, and Epson cards cost $135 each.

For LAN use, a third-party Ethernet interface card (which we didn't test) is available from Printer Systems Corp. for $695. TI anticipates that a Token-Ring option will be available by the end of the year. A $249 CommPlus board adds two serial, one AppleTalk, and a SCSI port, or you can buy a $50 serial interface with AppleTalk.

Paper handling is neatly managed by a bottom paper tray that slides under the unit and holds 250 sheets of letter- or legal-size paper. You can also add an optional multipurpose tray ($345) for 500 sheets of letter- or A4-size paper.

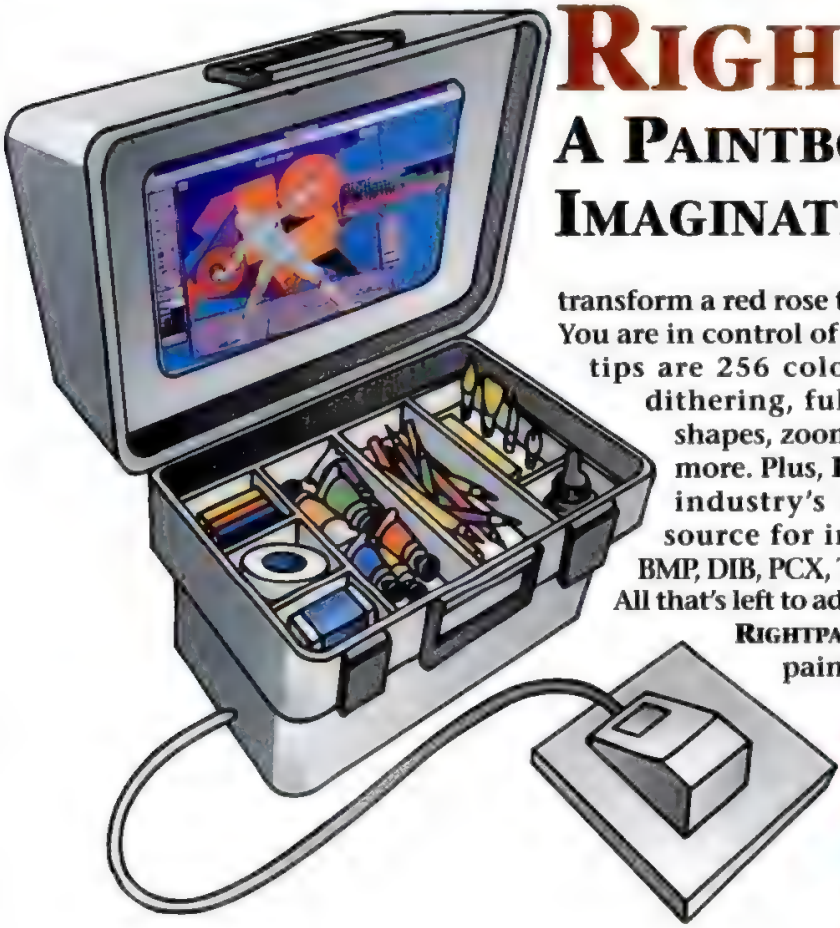
Setting printer parameters is easy using the 16-character LCD control panel, and you can get a printout of where you've been if you get lost in the menus.

The XL Turbo is a fleet-footed, inconspicuous shared laser printer that will please many workgroups with limited budgets. □

Texas Instruments Inc., *Information Technology Group, P.O. Box 202230, Austin, TX 78720-2230; 800-527-3500.*

TI microLaser XL Turbo *List price: $3,649. 1MB RAM upgrade (for PostScript), $109; 4MB RAM upgrade (for PostScript) $399; 1MB RAM upgrade (for PCL), $89; Diablo, Epson FX, or IBM Proprinter emulation, $135; HP font cartridges, $135 to $399; bar code font card, $205; 500-sheet letter- or A4-size paper cassette, $345; 500-sheet legal-size paper cassette, $90; 250-sheet executive- or A4-size paper cassette, $62 each; envelope cassette, $345; CommPlus board, $249; serial interface, $35; serial interface with AppleTalk, $50; drum, $145; developer, $195; toner cartridge, $66. Dimensions (HWD): 10.8 x 15.5 x 16.4 inches. Weight: 55 pounds. Emulations: Adobe PostScript Level 2, HP PCL 4.*

Circle 539 on reader service card



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COLOR POSTSCRIPT

Edging Toward The Mainstream

Whether you want the vibrant colors of thermal wax transfer, the versatility of solid ink, or the photo-realistic quality of dye sublimation, one of these eight color PostScript printers can meet your needs.

by M. David Stone

There's a color PostScript printer in your future, and probably sooner than you think. Once priced for a few high-end niche markets, color PostScript printers are beginning to enter the mainstream.

The advantages of color are obvious. Color gets attention; just ask Ted Turner. And it helps people to process information more readily. It's easier to track different colored lines across a line graph, for example, than it would be to follow those same lines on a black-and-white chart.

The hurdle for color is that quality output has always been expensive—both for the initial investment and in per-page costs. In the last two years, however, color PostScript printer prices have dropped from the stratospheric to the merely high.

This year, only two printers of the eight we saw are more than $10,000: the $10,995 Mitsubishi Diamond-Color Print 300PS, from Mitsubishi Electronics America, Information Systems Division, and the $11,900 Mitsubishi CHC-S446i ColorStream/DS, from Mitsubishi International Corp. But those two are based upon a technology fairly new to the color PostScript arena—dye sublimation. And even their cost doesn't seem so prohibitive when you consider that some dye sublimation systems that don't support Adobe PostScript in hardware such as the Kodak XL 7700, sell for $20,000 or more.

The single solid-ink printer in this roundup, the Tektronix Phaser III PXi, carries the same $9,995 price it did last year. Thermal wax transfer printers, however, have undergone a considerable price drop since our last review. Today, you can pick one up for as little as $4,995.

SUBLIMINAL SEDUCTION

Of the three technologies represented here, dye sublimation certainly qualifies as being

Photograph by Scott Wippermann

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the most exotic one.

When a dye sublimation printer heats its ribbon, the dye turns to a gas that diffuses over the paper or transparency and is then absorbed by a polyester coating. The diffusion process actually replaces well-defined dots with continuous-tone color. That makes this the technology of choice for images such as photographs. But diffusion blurs sharp edges on text and lines, making it a poor choice for graphics that include text or thin lines.

This year marks *PC Magazine*'s first review of printers using this technology. Dye sublimation printers are not new, but most have lacked hardware support of standard PC printer languages such as PostScript (though some have supported it by way of a PC-based software interpreter, such as ColorAge's $1,495 Freedom of Press). This year, the DiamondColor Print 300PS and the ColorStream/DS support Adobe PostScript Level 1 through an external controller and a plug-in card, respectively. The Tektronix Phaser IIsd ($9,995) includes Adobe PostScript Level 2 in firmware.

And there are more on the way. GCC Technologies had plans to ship its GCC ColorTone, priced at $10,999, by October. Mitsubishi Electronics added Adobe PostScript to its three-year-old, 150-dot-per-inch S340PS dye sublimation printer only this year.

While prices for PostScript dye sublimation printers are still among the highest, you can expect them to fall in the not-very-distant future. BIS Strategic Decisions (the marketing research firm) predicts that list prices may drop to below $8,000 before year's end and as low as $3,000 by 1995.

Prices for media and ribbons are also still high (see the chart "Price Comparison: A Look at Per-Page Costs"), but they may drop 20 to 40 percent before the end of the year, and by that much again in 1993.

As costs come down, the suitability of these products for reproducing scanned photos could make them the next component in the electronic darkroom of the future.

SOLID INK: A SOLID CHOICE

In last year's annual printer issue, the Tektronix Phaser III PXi earned an Editors' Choice. It's back this year, significantly upgraded, as the sole representative (once again) of solid-ink printers. The upgrade is a proprietary resolution enhancement technology that produces what appear to be smaller, less clearly defined dots. The result is output that approaches the photo-realistic look of dye sublimation printers, while still offering sharp edges for graphics and text.

By the time you read this, there should be at least one other solid-ink unit available: the Jolt PS ($6,999) from Dataproducts Corp. Brother International Corp. also plans to ship its Brother HS-1PS solid-ink unit (under $10,000) this year.

Rather than ribbons, solid-ink printers use blocks of wax that have about the same consistency as crayons. They melt the wax, then spit it out on paper in much the same way that liquid ink jets work. Solid ink, however, dries by cooling rather than evaporating a solvent. The technology can print on anything, including copier paper, and it prints transparencies with appropriate color saturation.

Most users of solid-ink printers are color professionals (corporate art departments, graphics service bureaus, and the like). Because of that, the prices of these printers will probably drop more slowly than with other technologies, moving from just under $10,000 this year to a likely $5,000 by 1995.

HEATING THINGS UP

Certainly the most popular technology for color PostScript printing is thermal wax transfer. These printers work by heating wax-based inks that adhere to paper or transparencies. Current versions require either coated or specially treated paper, but in most cases the stock is almost as lightweight as copier paper. The technology is known for vibrant, fully saturated colors that hold up well on transparencies.

There are four thermal wax transfer printers covered in this overview. Two of them—the Brother HT-500PS and the Tektronix Phaser II PXe—are A-size units priced

HIGHLIGHTS

Color PostScript Printers

COLOR POSTSCRIPT printers are coming down in price, and moving ever up in quality. You can buy a thermal wax transfer printer for as low as $4,995, and even the traditionally expensive dye sublimation printers are increasing in affordability. The Tektronix Phaser IIsd, for example, lists for the same price as the Tektronix Phaser III PXi solid-ink printer—$9,995.

DYE SUBLIMATION printers excel at reproducing photo-realistic images, but hand the floor to thermal wax transfer and solid ink when it comes to producing the sharp edges on lines and text required for presentation graphics.

THE HEWLETT-PACKARD PaintJet XL300 ink jet and the Xerox 4700 Color Document Printer laser represent rising technologies in the color PostScript market.

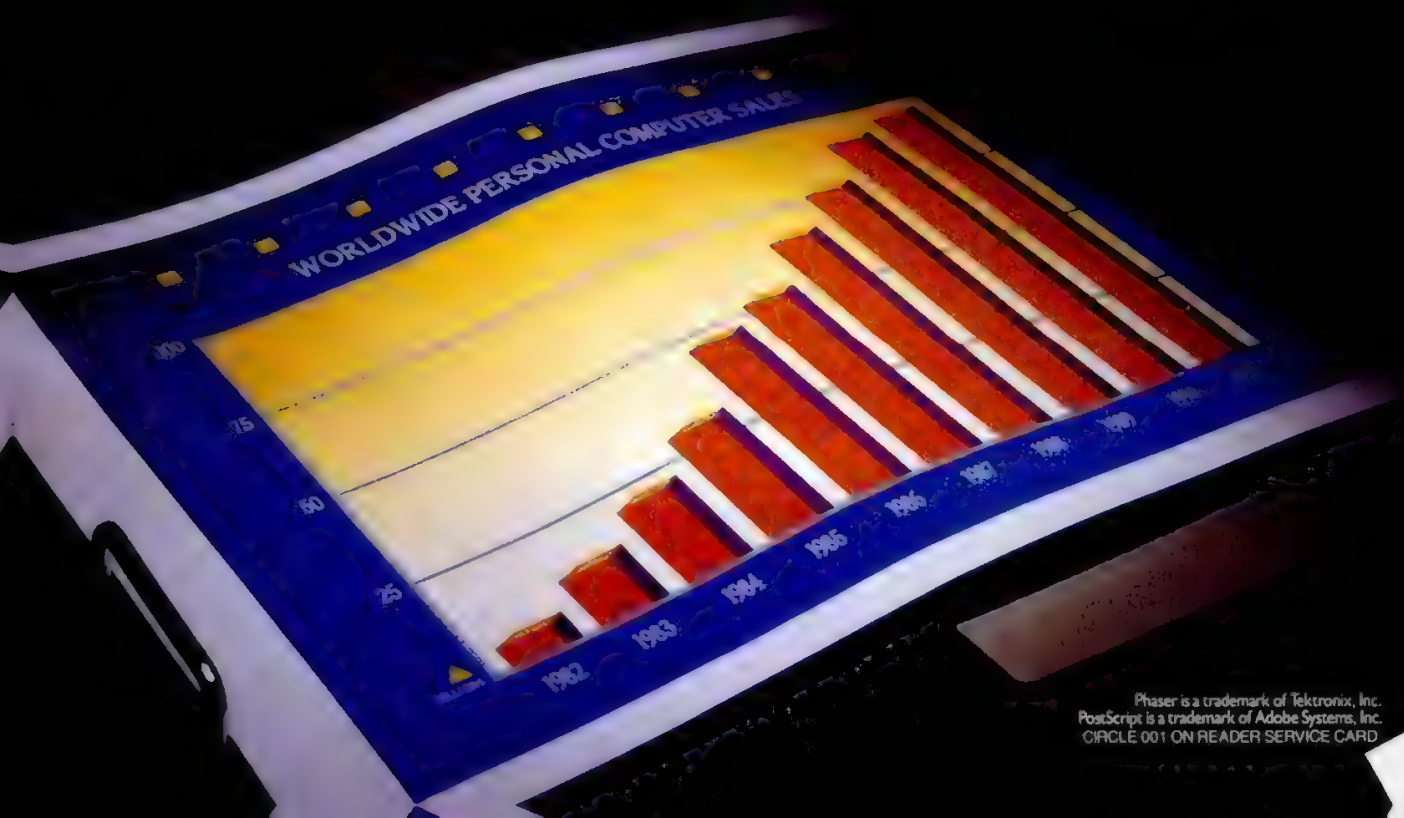
IN THIS REVIEW, only the three Tektronix printers included Adobe PostScript Level 2, but QMS and General Parametrics plan to include it in their next generation of printers.

YOU SHOULD judge these printers on the quality of their output, not their speed. The Tektronix Phaser II PXe managed 0.6 graphics pages per minute on our Graphics Speed test and was the fastest printer on our CorelDRAW test.

Rich color isn't just for rich guys.

The Tektronix Phaser™ II PXe color printer produces 16.7 million of the world's brightest, most vivid colors. It has a 16 MHz RISC processor on-board so it's as fast as you are. It supports Adobe PostScript Level 2 and HP-GL, it's networkable and can perform with PCs, Macintosh and workstation applications. It prints especially well on transparencies, too. And at less than $5000, you get an award-winning printer with all the latest features at an extremely affordable price. Call the leaders in color printing at 1-800-835-6100 Dept. 26E for a free output sample. Or call (503) 682-7450, ask for Document 1215 and we'll send information by fax. And get the color you need. At a price you can afford.

Tektronix
Computer Graphics



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CIRCLE 001 ON READER SERVICE CARD

at $4,995. The CalComp ColorMaster Plus 6613PS, priced at $6,995, is the newly introduced big brother to the CalComp A-size printer we reviewed last year. The QMS ColorScript 100 Model 30si ($9,995) is the latest improvement in the Model 30 line. What makes these upgrades worth a good look are their new B-size capabilities; this allows oversize prints for the full-bleed B-size images that graphic artists need.

Several other thermal wax transfer printers were not available for this review. Seiko Instruments USA's Personal ColorPoint PSE ($3,999) was in development at review time. In September, General Parametrics announced its PostScript Level 2 printer, the Spectra*Star Q10 ($4,999). We didn't review the company's Spectra*Star 450 ($14,990)—it is functionally identical to the Spectra*Star 430 we saw last year, but it adds a hard disk and filmmaking option. (All the 400 series units will, however, be upgradable to PostScript Level 2 via upcoming kits.) Additionally, Lanier Worldwide Systems is now an OEM licensee for the Spectra*Star 430, which it sells as the Lanier 4230 ($7,495).

QMS will also be introducing its ColorScript 210 ($4,995) and ColorScript 230 ($7,995) printers, with PostScript Level 2, 65 fonts, and more options for network connectivity. Computer Image Products declined to submit its BDS-2000P ($9,995) and FDS-3000P ($4,995). Finally, Mitsubishi Electronics' three-year-old $9,995 thermal wax transfer G-650 just recently began shipping with a PostScript upgrade.

With predicted price drops to as low as $3,000 within two years, the thermal wax transfer market will be stronger than ever. BIS projects shipments growing to 71,000 in 1995 (note, however, that this also includes non-PostScript printers).

NEW TECHNOLOGIES

Two new technology entries in the color PostScript market are two old technologies—ink jets and electrophotographic printers (better known as lasers but also including related technologies).

The HP PaintJet XL300 (see "Ink Jets: True Colors Shine Through" in this issue) represents the first of the color PostScript–capable ink jets. Though the PostScript option was not shipping in time for our tests, it will be available by the time you read this. At a list price of $4,995 with PostScript, the HP PaintJet XL300 equals the cost of either the Brother HT-500PS or the Tektronix Phaser II PXe. Unlike these two, however, the PaintJet XL300 handles up to B-size stock. None of the B-size printers we look at here costs less than $6,995.

The price advantage goes to ink jets, and you can expect to see more in this category. Ink jets also number among their strengths the ability to print on plain copier paper. Alas, transparencies on most ink jets usually lack the saturated colors typical of thermal wax transfer.

Electrophotographic color PostScript printers are just becoming a reality. Electronics for Imaging (San Bruno, California, 415-742-3400) sells the $35,000 Fiery controller as an add-on for several high-end color copiers—the Canon CLC-300 and CLC-500, the Kodak ColorEdge 1550 and ColorEdge 1525, and the Xerox 5775. The total price of copier plus controller ranges from around $60,000 to just under $90,000.

Within a year, you may see several desktop electrophotographic color PostScript printers available for under $10,000. And by the time you read this, Xerox Corp. should have announced its departmental color PostScript printer (as opposed to a copier that can also print).

Xerox claims that the Xerox 4700 Color Document Printer will print 7.5 color pages per minute (ppm) at 15 cents per page, and 30 black-and-white ppm at 2.5 cents per page. Although the $43,665 price tag is high, this one printer could actually save you money by eliminating the need for several desktop printers.

NETWORK-READY, STORAGE-STEADY

In this review, all but the Brother, CalComp, and QMS printers offer (or had plans to offer) Ethernet options for direct attachment to a network. One highly welcome trend among these printers—which all include parallel, serial, and AppleTalk

PC MAGAZINE ▶ EDITORS' CHOICE

- **Tektronix Phaser IIsd**
- **Tektronix Phaser III PXi**

This year's Editors' Choice awards for color PostScript printers go to both a new favorite and a proven—and improved—former winner. The Tektronix Phaser IIsd ($9,995) is the clear choice of the current dye sublimation printers, merging photographic quality output with the lowest price of the three printers in this category. All the reasons that earned the Tektronix Phaser III PXi solid-ink printer ($9,995) the Editors' Choice last year apply again this year, as does one more: its Finepoint resolution enhancement technology.

The IIsd already shows itself to be a mature product in a fairly new category: color dye sublimation printers with hardware support for the Adobe PostScript language. And it leaps ahead of its peers by building in Adobe PostScript Level 2, at that. (In fact, of the eight printers reviewed here, only the Tektronix systems provide PostScript Level 2.)

While all the dye sublimation printers we reviewed for this issue provide the continuous-tone output that makes any of them the hands-down choice for reproducing scanned images, the others falter when it comes to producing the sharp edges required of text and lines. Certainly, the IIsd's text and hairline rules aren't as solid or as dark as those of solid-ink or thermal wax transfer printers, but they are surprisingly good for a technology whose very diffusion process depends on blurring sharp edges. The credit for this goes to Tektronix's Photofine resolution enhancement technology.

Tack on the fact that this is the only one of the dye sublimation printers to

come in under $10,000, and you can see why this is the choice for users who need high-quality, photo-realistic, continuous-tone image reproduction, and reasonable quality text or line output for occasional graphics work.

REPEAT PERFORMANCE

Last year, the $9,995 Tektronix Phaser III PXi's ability to get quality output on anything from plain paper to paper towels helped earn it the Editors' Choice. So did its B-size capability (with only a small unprintable margin area), its ease of use, its ability to print fully saturated colors on transparencies, and its inclusion of PostScript Level 2.

This year's model provides you with the same sharp-edged text and graphics, while at the same time approximating the continuous-tone look of dye sublimation printers for image reproductions. The magic comes courtesy of the system's Finepoint resolution enhancement technology, which minimizes the visual effect of dots.

The III PXi can't match the photorealism of the IIsd, but it is far better suited to a larger share of the market: professionals whose primary purpose is to produce colorful, high-quality presentation graphics.

HONORABLE MENTIONS

If high-quality color output at the lowest cost is your main concern, most of the thermal wax transfer printers we review here will probably satisfy. Two units—the Brother HT-500PS and the Tektronix Phaser II PXe—are available for as little as $4,995. You may also be interested in investigating the HP PaintJet XL300, reviewed in the ink jet section of this issue; it also lists for $4,995 with PostScript and supports B-size printing.

If you must have B-size or B-oversize bleeds and the fully saturated colors of thermal wax transfer technology, consider springing for the CalComp ColorMaster Plus 6613PS ($6,995). Among its attributes are B-oversize capabilities (though memory upgrades to the 18MB you'll need to make use of this require proprietary SIMMs and are expensive) and output quality that is among the best of the four thermal wax transfer printers.

connections—is support for automatic interface switching. The only one that lacks it is the QMS device.

Additionally, all but the Tektronix Phaser II PXe have some provision for a hard disk for storing fonts. The DiamondColor Print 300PS includes a 40MB disk; the others provide a SCSI port for attaching an external drive. (Only the ColorStream/DS also includes a SCSI port for connection to the outside world.)

Of this group, only the QMS and Tektronix printers offer true Adobe PostScript, and only Tektronix offers Level 2. Finally, only the CalComp, QMS, and Tektronix printers are Pantone-certified.

PERFORMANCE TEST RESULTS

These printers should be judged primarily on the quality of their output, not their speed. Fast performance is not their strong suit. The thermal wax transfer devices were the fastest group on our tests, with the QMS ColorScript 100 Model 30si managing a respectable 0.5 graphics pages per minute (gppm) using A-size paper. The Phaser II PXe was faster with A-size paper, but it uses only a 3-pass rather than a 4-pass ribbon. And with B-size paper, the Model 30si tied the Phaser II PXe's A-size score of 0.6 gppm.

The dye sublimation printers were all grouped in the cellar, with 0.1 to 0.2 gppm. The Phaser IIsd had noticeably faster performance on our CorelDRAW test, however, helping it stand out in this crawl contest. The solid-ink Phaser III PXi was no faster than the IIsd on our Graphics Speed test with A-size paper (0.2 gppm), but managed 0.3 gppm with B-size paper. It was also appreciably speedier than the IIsd on our CorelDRAW test.

This year, we introduce quality tests for determining the range and purity of color PostScript printer output. Our tests using a Gretag SPM 50 spectrophotometer show a strong similarity among the printers, each producing a color gamut (that is, the range of printable colors a system can reproduce) of like size and shape, with only minor variations. Generally, the color gamut for each printer is large, and the colors are bright. All, however, fall short in their interpretation of blue, but that's to be expected because the pigments in the inks and dyes are inherently more limited in the range of blues they can produce. (For a look at each printer's color gamut, see "How We Tested" in "Performance Tests: Color PostScript Printers.")

On most of the printers, both the naked eye and our spectrophotometer discovered little, if any, difference between pure black (available only with printers that use a four pass-ribbon) and process black.

IT'S A COLORFUL LIFE

When choosing a printer, pick the technology that best fits the kind of output you plan to produce. Consider whether you'll use continuous-tone images, graphics with text, or both, and whether you'll need output on paper, transparencies, or both. If you need output on paper, consider whether you'll be satisfied with heavy- or light-coated stock, or whether you require standard paper.

Once you've decided on the technology, look at the individual printer for important features such as its maximum paper and image sizes and the quality of its output. The following reviews cover all this and more to help you decide which system will add the most color to your life.

Brother International Corp.

Brother HT-500PS

ALL REVIEWS BY
M. DAVID STONE

Brother International Corp.'s broad range of printers—everything from dot matrix to ink jets and lasers—has just gotten broader. The Brother HT-500PS ($4,995) adds full-color thermal wax transfer technology to the lineup. With a street price of about $4,300 to $4,500, this is one of the least expensive of the high-end color units.

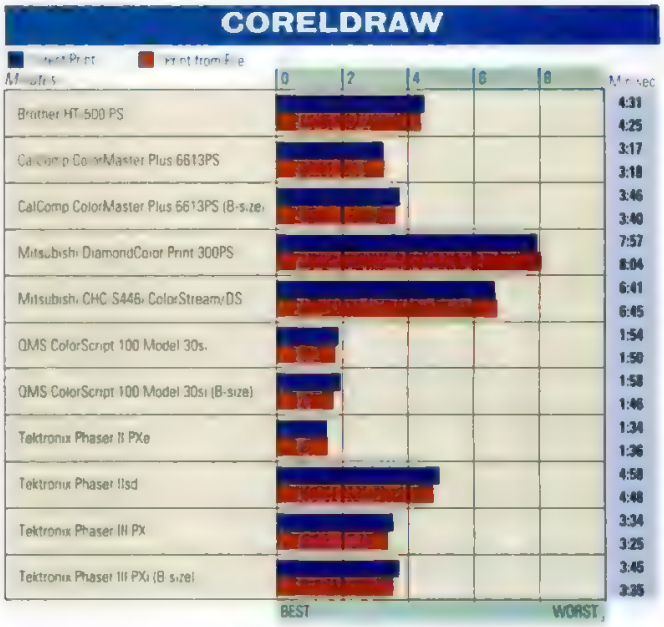
The printer is built around the 300-dot-per-inch Mitsubishi G370 engine. Though the printer can use a four-pass ribbon, the company rates the engine

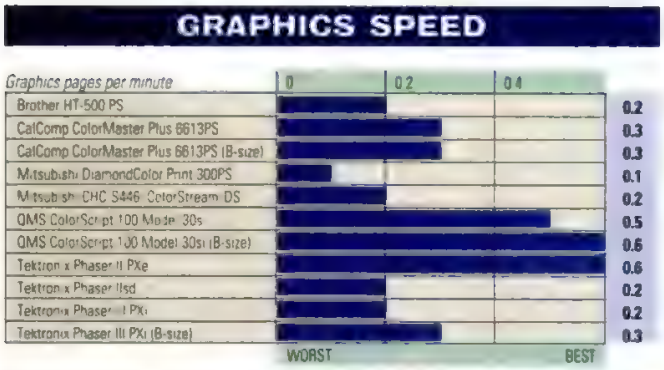
Performance Tests: Color PostScript Printers

The Tektronix Phaser II PXe, a thermal wax transfer printer, proved the fastest on our A-size tests, but it was also the only one to use a three-pass ribbon.

Second-fastest A-size honors fell to the QMS ColorScript 100 Model 30si, a thermal wax transfer device that uses a four-pass ribbon.

In B-size mode, the Model 30si matched the Graphics Speed performance of the Phaser II PXe with A-size paper.





Unless otherwise indicated, test results reflect performance using A-size paper. We also report performance using B-size paper for the three printers that provide that capability.

The **Graphics Speed** test measures the printer's speed in sending and printing two copies of a graphics image created using CorelDRAW and Microsoft Windows 3.1.

The **CorelDRAW** test measures the time required to print a CorelDRAW graphics file. We run the test in two different ways: first as a direct print from within the application (Direct Print) and then as a print of a pregenerated file external to the application (Print from File). It uses the same graphics file as the Graphics Speed test does. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

speed (1 minute per page) only with a three-pass ribbon. You won't find a RISC processor on-board the Brother controller, but there is a 60-MHz Texas Instruments 34010. You can expand the 5MB base memory to 21MB with standard SIMMs.

Brother uses its own BR-Script, a Level 1 PostScript-compatible interpreter that includes 35 fonts. The HT-500PS was also the only unit to offer HP PCL 4, which came with a proprietary set of color commands. In addition, it includes HPGL emulation. The HT-500PS earns points for an accurate automatic sensing feature that monitors the data stream and switches emulations as needed.

A LOOK AT PERFORMANCE

On our standard test images, the HT-500PS showed solid hairline rules, vibrant colors, and dark blacks. (It also did better than many when printing text in black.) To the naked eye, its process black is nearly indistinguishable from its 100 percent black; indeed, the spectrophotometer picked up only a slight difference between the two. On the gradient test, the output showed uneven blotches of color going from green to yellow, but it is still better than the QMS ColorScript 100 Model 30si or the Tektronix Phaser II PXe.

Brother HT-500PS

The sample scanned photos, however, printed relatively dark, with a red tinge; this indicates a Microsoft Windows driver that is not well tuned for the printer. But most graphics programs should let you compensate for this.

The HT-500PS was the slowest of the four thermal wax transfer printers on the A-size Graphics Speed test, scoring 0.2 graphics pages per minute in PostScript mode. It was also sluggish on our CorelDRAW test.

The HT-500PS is limited to letter-size transparencies and letter- and legal-size paper (the image areas of 8.1 by 12 inches for legal-size paper is notable). A standard letter-size tray holds 100 sheets of paper or transparencies; a costly $245 cassette holds 100 letter- or legal-size sheets. The standard front-mounted output tray holds 50 sheets and hosts a handy manual-feed slot.

The HT-500PS has some shortcom-

Photographs by Thom O'Connor

CONTINUES

All eight color gamuts show a strong similarity. These printers are characterized by a large color range, as well as by the expected weak interpretation of blue in comparison with other colors. For most, process and pure black are nearly indistinguishable from each other.

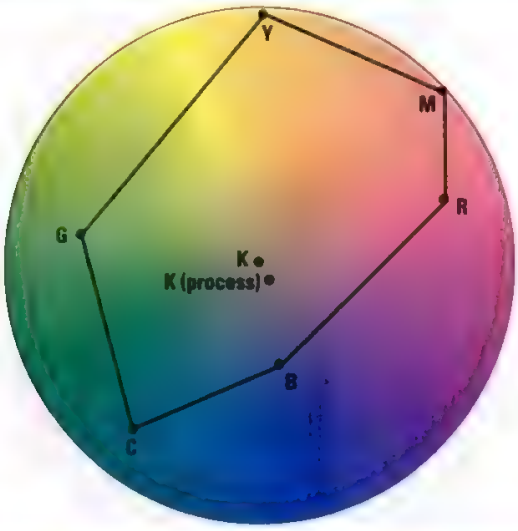
HOW WE TESTED

To determine each system's range and purity of color, we used a PostScript program to output samples of the primary CYM colors (cyan, yellow, and magenta), process RGB colors (red, green, and blue), and process and pure black (K). Pure black is available only on those printers that support four-pass ribbons; that includes all of these color PostScript units except the Tektronix Phaser II PXe.

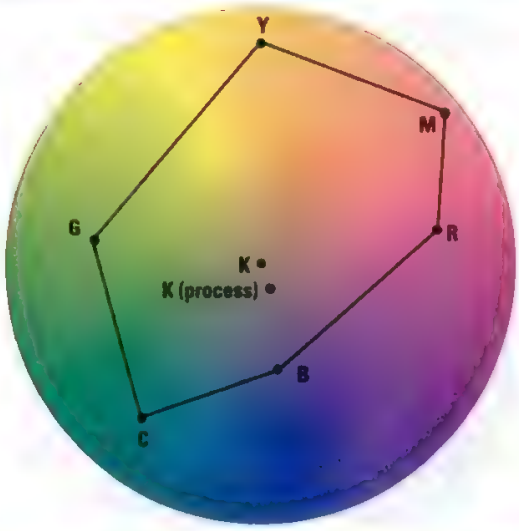
Using a Gretag SPM 50 spectrophotometer, we measured each color sample to obtain the location of each color on the red-green axis and the yellow-blue axis in the CIE (Commission Internationale de l'Eclairage) L.a.b. color space (which is a three-dimensional representation of color, including lightness). We have plotted these coordinates in two dimensions (not including lightness) to show each printer's color gamut—the range of printable colors it is capable of reproducing. Each point on the accompanying plots is labeled for the color it represents. We also measured the density—ink-layer thickness and pigment concentration—of the process and pure-black samples.

Before we began the spectrophotometric readings, the Gretag SPM 50 was calibrated to the paper on which the samples were printed (each manufacturer supplied paper for its own printer). All color readings were taken under fluorescent light, with the sample page placed over a white foam board to minimize the effects of paper translucence.

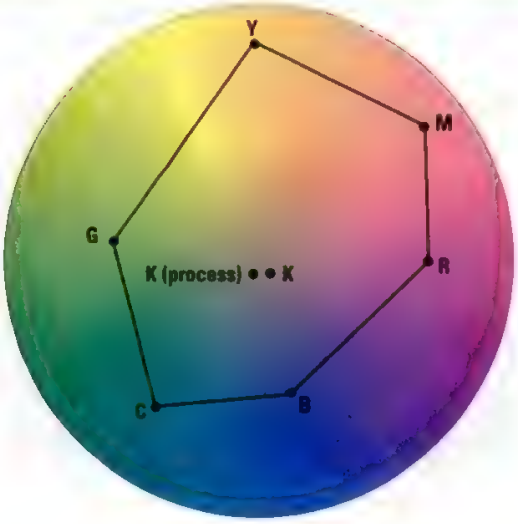
Brother HT-500PS



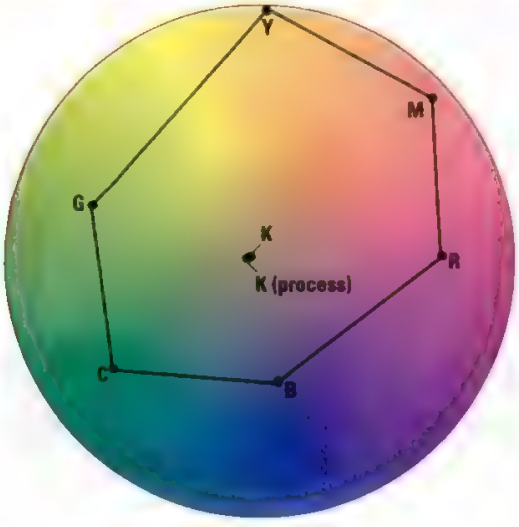
CalComp ColorMaster



Mitsubishi DiamondColor Print 300PS

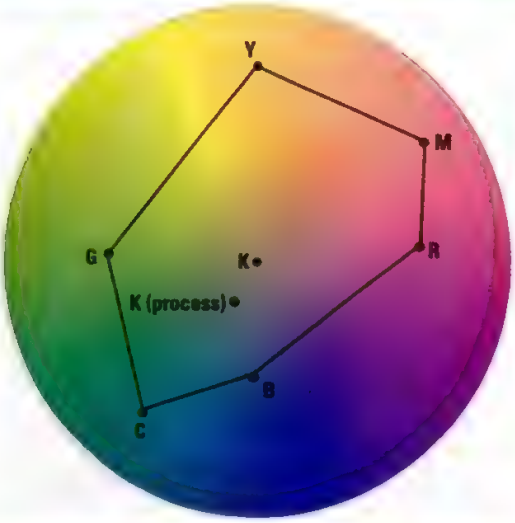


Mitsubishi CHC-S466i ColorStream/DS

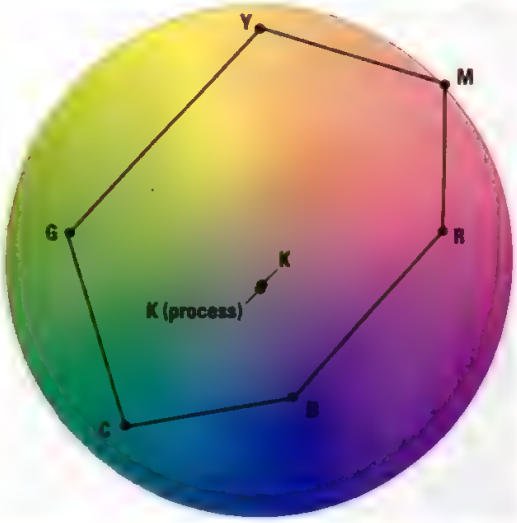


ENDS

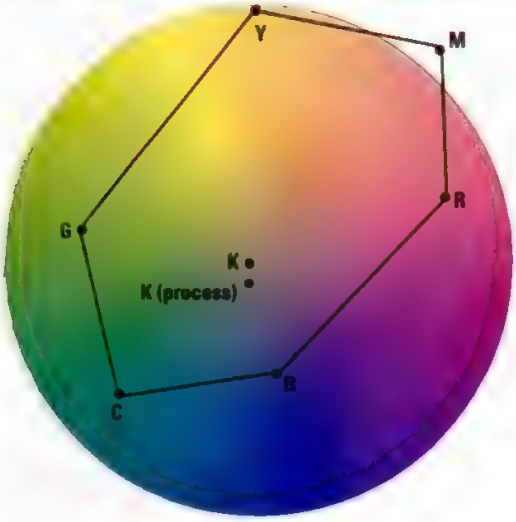
QMS ColorScript 100 Model 30si



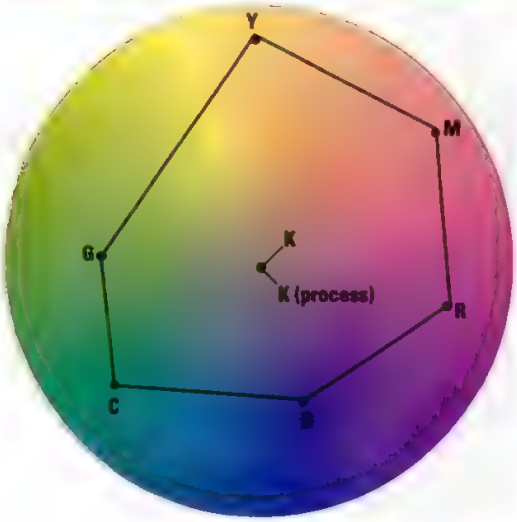
Tektronix Phaser II PXe



Tektronix Phaser IIsd



Tektronix Phaser III PXi



ings, the most significant being its Windows driver. But it also has a number of welcome conveniences, such as the manual feeder. Most important, its $4,995 price tag gives the HT-500PS the distinction, for now, of tying for the title of least expensive high-end color printer. And that makes it an inexpensive ticket for admission to the color game.

Brother International Corp., *200 Cottontail Ln., Somerset, NJ 08875-6714; 908-356-8880, ext. 4300; fax, 908-469-4415.*

Brother HT-500PS *List price: $4,995; 100-sheet (paper or transparency) letter- and legal-size paper cassette, $245; one-, three-, or four-color ribbon, $105; paper: 1,000 legal-size sheets, $88, 1,000 A-size sheets, $70; transparencies: 100 A-size sheets, $90. Dimensions (HWD): 11.3 x 16.8 x 21.8 inches. Weight: 65 pounds. Emulations: Brother BR-Script PostScript interpreter, HPGL, HP PCL 4. Circle 470 on reader service card*

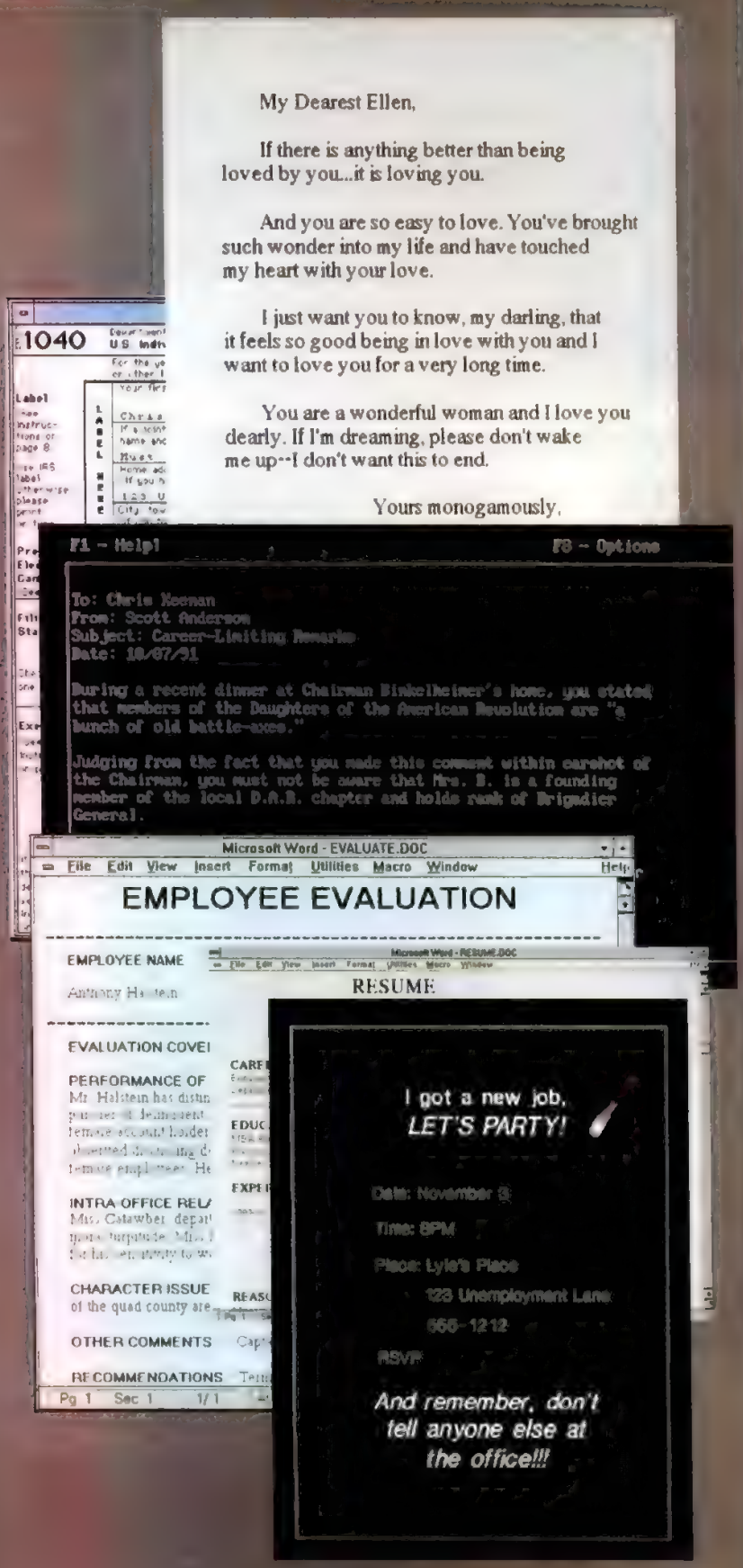
CalComp Inc.

CalComp ColorMaster Plus 6613PS

If you need high-quality, B-oversize output at a reasonable price, the CalComp ColorMaster Plus 6613PS will provide it. An industrial-strength thermal wax transfer printer, the 6613PS ($6,995) is big, heavy, and built to last.

The 6613PS is the big brother of the ColorMaster Plus 6603PS we reviewed last year. But where the 6603PS (now $4,995) is limited to letter-, legal-, and A4-size paper, the 6613PS handles all of those plus B- and B-oversize paper.

At the heart of this printer is CalComp's own 1.4-minute-per-page engine (with a four-color ribbon) and its own controller, with a 16-MHz Intel i960KB RISC chip. Base memory is a reasonably ample 10MB, but proprietary SIMMs make upgrades expensive. The upgrade to 18MB—the minimum needed for



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CIRCLE 286 ON READER SERVICE CARD

FIFTH GENERATION SYSTEMS, INC

Brother HT-500PS — $4,995

Mitsubishi G370 engine-based thermal wax transfer printer with BR-Script PostScript compatibility and HP PCL 4

A-SIZE:
PS Graphics Speed: 0.2 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 4 min. 31 sec.
CorelDRAW (File): 4 min. 25 sec.

CalComp ColorMaster Plus 6613PS — $6,995

CalComp 6613 engine-based thermal wax transfer printer with a RISC processor and PhoenixPage PostScript compatibility

A-SIZE:
PS Graphics Speed: 0.3 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 3 min. 17 sec.
CorelDRAW (File): 3 min. 18 sec.

B-SIZE:
PS Graphics Speed: 0.3 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 3 min. 46 sec.
CorelDRAW (File): 3 min. 40 sec.

Mitsubishi DiamondColor Print 300PS — $10,995

Mitsubishi S3600-30 engine-based dye sublimation printer with a RISC processor and PowerPage PostScript compatibility

A-SIZE:
PS Graphics Speed: 0.1 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 7 min. 57 sec.
CorelDRAW (File): 8 min. 4 sec.

Mitsubishi CHC-S446i ColorStream/DS — $11,900

Shinko CHC-S446i engine-based dye sublimation printer with a RISC processor and PowerPage PostScript compatibility

A-SIZE:
PS Graphics Speed: 0.2 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 6 min. 41 sec.
CorelDRAW (File): 6 min. 45 sec.

QMS ColorScript 100 Model 30si — $9,995

Mitsubishi G650 engine-based thermal wax transfer printer with Adobe PostScript

A-SIZE:
PS Graphics Speed: 0.5 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 1 min. 54 sec.
CorelDRAW (File): 1 min. 50 sec.

B-SIZE:
Graphics Speed: 0.6 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 1 min. 58 sec.
CorelDRAW (File): 1 min. 46 sec.

A Guide to Color Printing

by Catherine Kunkemueller and M. David Stone

Whether you want to be a color guru or just want spicier presentations, this *PC Magazine* foldout will help. We'll walk you through the theory—and the pitfalls—of producing color output. Finally, we'll provide a close-up look at the quality you can expect from current color printing technologies, including an analysis of samples from four of the color-capable printers (ink jet, thermal wax transfer, solid-ink, and dye sublimation) reviewed in this issue.

You might suppose that colors are precise and unchanging—that *teal* means the same thing to all people. Not so. People looking at the same picture rarely agree on the exact colors. And if you change the lighting, background, adjoining colors, or half a dozen other variables, even the same person will perceive the same color as having changed.

One of the greatest challenges of working with color is finding a way to describe colors so you can predict the final output. What you ideally need is a device-independent color scheme: a way to describe colors so that the colors on your screen will match those output from your printer, or from any other printer.

The CIE XYZ color space is a perception-based device-independent color scheme.

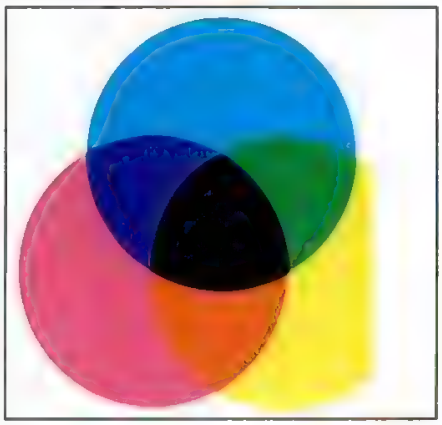
In their search for exact color reproduction, many companies are focusing on the Commission Internationale de l'Eclairage's 1931 CIE XYZ space. The perception-based CIE XYZ space is a mathematical map of all visible colors; a particular CIE XYZ number always refers to one certain color. Adobe PostScript Level 2, for instance, uses the CIE XYZ color space as its reference when it is preparing color output.

But device-independent color won't solve everything. Even when there's total agreement on the color that you want to produce, you are limited by the colors available to the monitor, printer, or other device that you're using. The *color gamut* for any existing device—the range of colors it can produce—is a subset of all possible colors. The color gamut varies from one device to another, but each technology has its own typical range. Monitors, for example, can produce rich blues that you'll never coax out of a printer. When the color gamuts of your printer and monitor don't overlap at the point that you want to print, you usually end up with whatever the printer driver thinks is the closest approximation.

Color gamuts for one type of device can also differ according to technology. For instance, dye sublimation printers are typically stronger in yellows than thermal wax transfer printers. Even within one printer technology—say, thermal wax transfer—printers use different inks, which also affects output.

The issue of calibration arises because even identical models of a particular device can produce different colors. Fewer variation problems arise with printers, though the heating mechanism used in some units to melt the ink can vary slightly in temperature. Fluctuations in monitor colors are more noticeable: Not only can your monitor produce different colors from an identical model on the next desk, but your monitor's colors may alter as ambient light changes during the day, or as phosphors age.

In order to match on-screen colors to output colors effectively, you must ensure that your devices consistently output the same colors under similar circumstances. *Calibrating* each device involves resetting all relevant parameters to some known state (much like tuning a piano). Unfortunately, the hardware-independent calibration methods currently available for printers are limited to Macintosh applications. A few monitors allow you to adjust the intensity of the different-colored electron beams, or you can measure the white point of your display and calibrate it to match another display (see "Matching Color at Gunpoint" in the June 30, 1992, issue for details on monitor color matching).



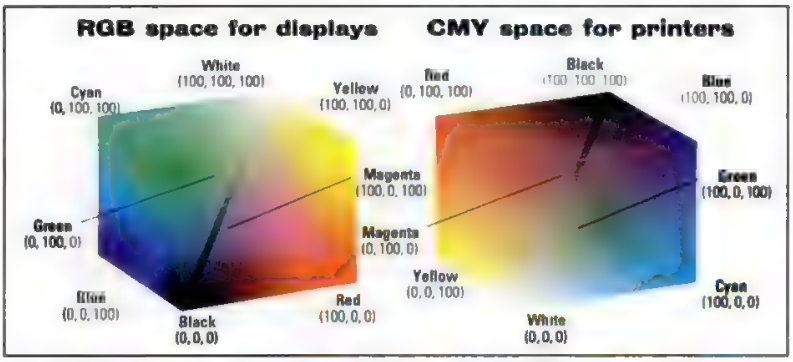
To create output from CYM colors, printers start with the white of the paper and add inks that reflect certain light waves to produce colors. For instance, cyan ink absorbs all wavelengths but cyan.

TRANSLATION TROUBLES

One reason that color gamut problems arise is that devices produce color according to different schemes. Monitors use the RGB (red, green, blue) color model; printers use the CYM (cyan, yellow, magenta) or the CYMK (with black) model. The cyan, yellow, and magenta used by a printer are process colors; mixing these inks can produce any color (including process black).

Since there is no standard mixing scheme to designate any given color in either the RGB or CYM(K) model, there is no simple way to map monitor colors to printer colors or guarantee that a particular mix of CYM(K) values will result in a particular color on the page. Under the current system, for instance, how a CYM(K) value ends up on the page is determined by the particular device.

One of the first attempts to match on-screen colors with output colors involved preparing specific swatches as a reference for each desired color. This approach is used by spot color systems, such as Pantone, TruMatch,



Your monitor and printer refer to different color models: the RGB and CYM models, respectively, each containing all the visible colors. Each model can be pictured as a cube, with the different colors and color combinations at various points in the three-dimensional space.

solid-ink, and dye sublimation printers. (Note that the HP PaintJet XL300 output reproduced here was created under the printer's HP PCL 5C emulation, because the PostScript option was not shipping at press time.)

Solid Ink
(Tektronix Phaser III PXi)

Solid-ink printers will print on just about anything that can make it through the print mechanism without jamming. The images shown here were printed on standard copier paper.

Currently the only representative of its breed (though that should soon change), the Tektronix Phaser III PXi uses a proprietary resolution-enhancement feature that minimizes the dots you see in the photos. The final result has a smoother, more photo-realistic look than photos printed with either liquid ink jet or thermal wax transfer technology.

On the text and graphic sample, the solid-ink printer produced suitably solid colors as well. The black-on-white text is fully readable, while white-on-black text is second only to the thermal wax transfer sample. Solid-ink printers are also known for printing transparencies with fully saturated colors, though the transparencies should be laminated for best effect.

Dye Sublimation
(Tektronix Phaser IIsd)

Dye sublimation printers require a special heavyweight coated stock, similar in look and feel to glossy photographic paper. As the images reproduced here show, the quality of output resembles a photograph as well.

This technology provides continuous-tone color, which makes it ideal for reproducing photographs. You won't see any dots in the output, and you won't see any discontinuities in colors. There simply aren't any.

Dye sublimation printers are also known for having trouble printing text and other thin lines, as in a line graphic. The Tektronix Phaser IIsd includes a resolution-enhancement technology that provides notably better text output than most. Even so, the text and graphic samples show that text quality is not the technology's forte. Dye sublimation printers have the same strengths and weaknesses for transparencies as for paper: They're strong on continuous-tone photographs, weak on thin lines.

GbsSlipBack-001B

Back

1. Follow instructions on the other side

Inverted Back

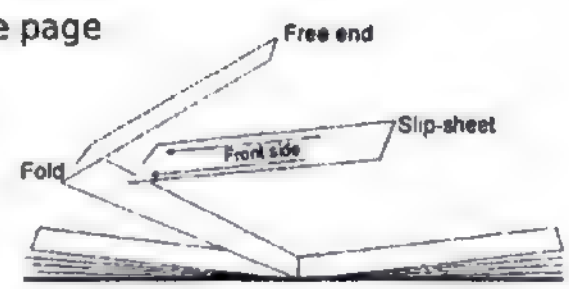
1. Follow instructions on the other side

Folded edge of the page

GbsSlipSheet-001

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

A Guide to Color Printing

With several technologies to choose from for color PostScript output, you should focus on the technology first and then choose the printer. The samples reproduced here will let you compare the output quality of 300-dot-per-inch ink jet, thermal wax transfer,

Liquid Ink Jet

(HP PaintJet XL300)

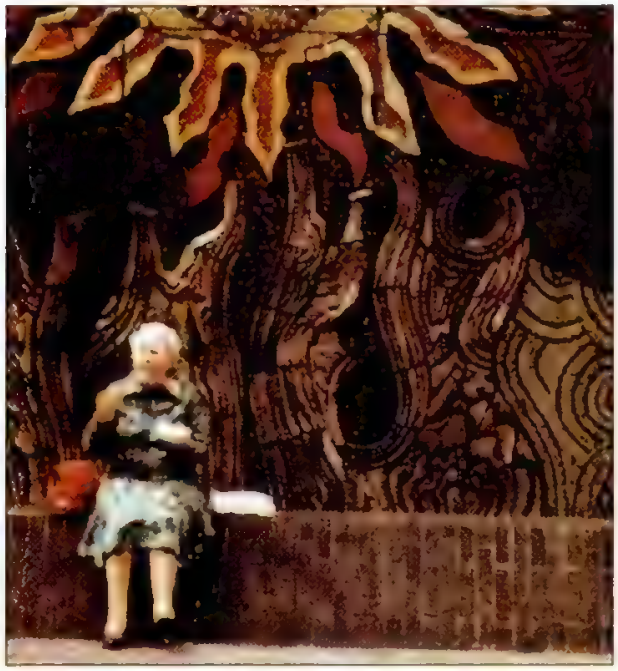
Ink jet printers boast the ability to print on standard paper. The images shown here were printed on a quality bond paper provided with the printer.

For ink jet technology, the HP PaintJet XL300's color quality is impressive, only narrowly missing the output quality of the more expensive technologies. But the image loses some detail in the woman's face in the top picture. On the crayon sample, it printed what appears to be a textured surface for the yellow crayon. And in part of the image that isn't shown, it produced a muddy color for some of the darker-color crayons.

Much more important is a slight bleeding in the text samples. Black-on-white text printed without problems. But when the printer is printing white text on a color background, the color tends to fill in the text, particularly when smaller type is used. Some "solid" colors, such as light blue, show an obvious dot pattern from dithered colors. Some liquid ink jet printers may also produce less satisfactory transparencies than other options (though the PaintJet XL300 impressed us with the quality of its transparencies), since the colors tend to be less saturated than with other technologies.

Thermal Wax Transfer

(QMS ColorScript 100 Model 30si)



Thermal wax transfer printers may soon be able to print on standard copier paper, but the technology isn't quite there yet. The images reproduced here were printed on an uncoated but prepared paper designed specifically for the printer.

Patterns of dots are easily visible in both of the printed photos, much more than in the other technologies represented here. But the text and graphics sample for the Model 30si exemplifies a thermal wax transfer trait: it is far crisper and cleaner than what any of the other technologies produce.

All the text remains fully readable down to 6-point type, even with white text on a colored background. Just as important for graphics, the solid colors do not show an obvious dot pattern. Thermal wax transfer printers are also well known for printing transparencies with suitably saturated colors, one of the technology's best points.

and Focoltone. Spot colors work for getting one or two particular colors right (in the company's logo, for instance), but the spot color gamut is not continuous. Many color printers are Pantone-certified, which means they can produce output close to a particular color swatch.

Another color-matching method concentrates on taking whatever screen colors exist and trying to match those (instead of referring to a device-independent system). For instance, since 1991, Hewlett-Packard color printers have shipped with proprietary color-matching systems that let you designate your monitor's brand when you install the printer. A color look-up file (predetermined for the specific brand of monitor) is then sent to the printer. The result is output optimized for that monitor's phosphor colors; some units also let users add vividness.

Tektronix, on the other hand, takes advantage of PostScript Level 2's use of CIE values to allow users to adjust output color for their printers. (The Tektronix units reviewed in this issue were the only color systems we saw with support for PostScript Level 2.) Tektronix users can set DIP switches to select color adjustment options that reassign the CYMK values sent to the printer; they can heighten the cyan value, for instance. Instead of simply matching the screen color, the user can opt to match a printing press or retain color vibrancy.

Color-management software, such as EFI's EfiColor and Kodak Electronic Printing Systems' Precision Color Management System, converts an RGB value to the CIE standard and then determines the CYM(K) equivalent. Both systems use color translation files designed for specific devices. Both the EFI and KEPS systems are currently shipping as Macintosh applications, but they aren't due out in PC form until mid '93. Microsoft has plans for a system-level color-management system, but not until after Windows NT.

Eventually an industry-wide standard (or two) for optimizing color reproduction should appear. But the first step toward color communication—making sure everyone is speaking the same language—needs practice.

BETTER OUTPUT

Some color problems surface only after the page is printed. Here's what you may find, and what you can do about it.

Blending colors is popular for making presentation backgrounds and is necessary for photo-realism. But with some printers, the colors remain separated into discrete chunks, or dots of unwanted colors permeate the area. The usual culprit of uneven blending is the printer's dithering pattern—the printer's means of producing colors beyond its inks (cyan, yellow, magenta, and maybe black), simple overlaps (red, green, blue), and white (plain paper). To make additional colors, the printer staggers dots of different colors, which the human eye blends together into the desired color. The dithering pattern controls the placement of these different colors.

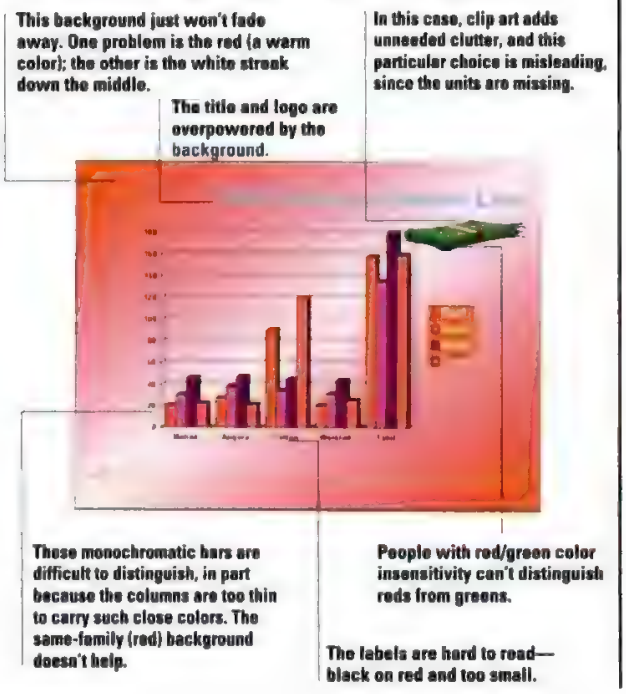
You won't be able to fix the dithering pattern in your printer, but many software packages give you some control. If you're doing simple charts, try to stick with the eight clearest colors (CYMK, RGB, and W).

Another common flaw in color output is moiré patterns, or tiny repetitive designs in the color. These show up particularly in midtones, where both cyan and magenta are strong. Moiré patterns are the product of misaligned screen angles; most software packages let you adjust these angles. PostScript Level 2 also allows for more precise screen angles, which should further minimize moiré problems once applications start to take full advantage of it.

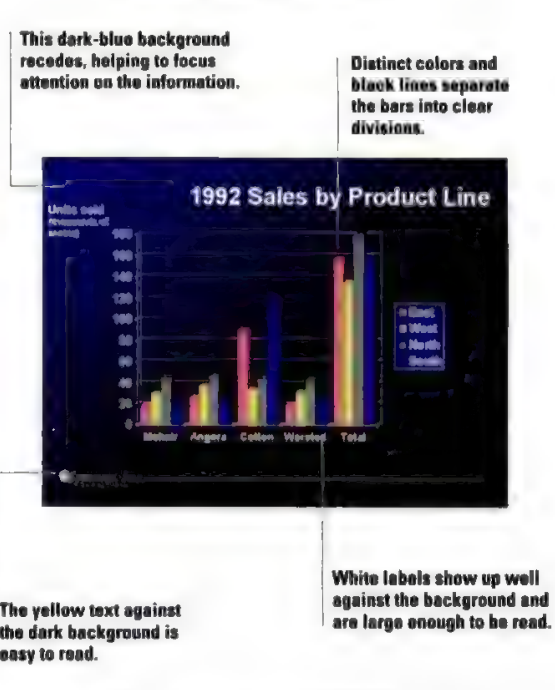
Printers that lay down multiple passes of inks can develop registration problems, usually seen as white spaces around a figure. Some software packages let you *trap* colors—extend the lighter color into the darker shade to cover up any gaps. But trapping can be difficult, and if you're making a color proof to be sent out to a bureau for the final piece, consider letting the experts do the trapping. (For more on making color separations, see "Separations Without Trial" in our September 24, 1991, issue.)

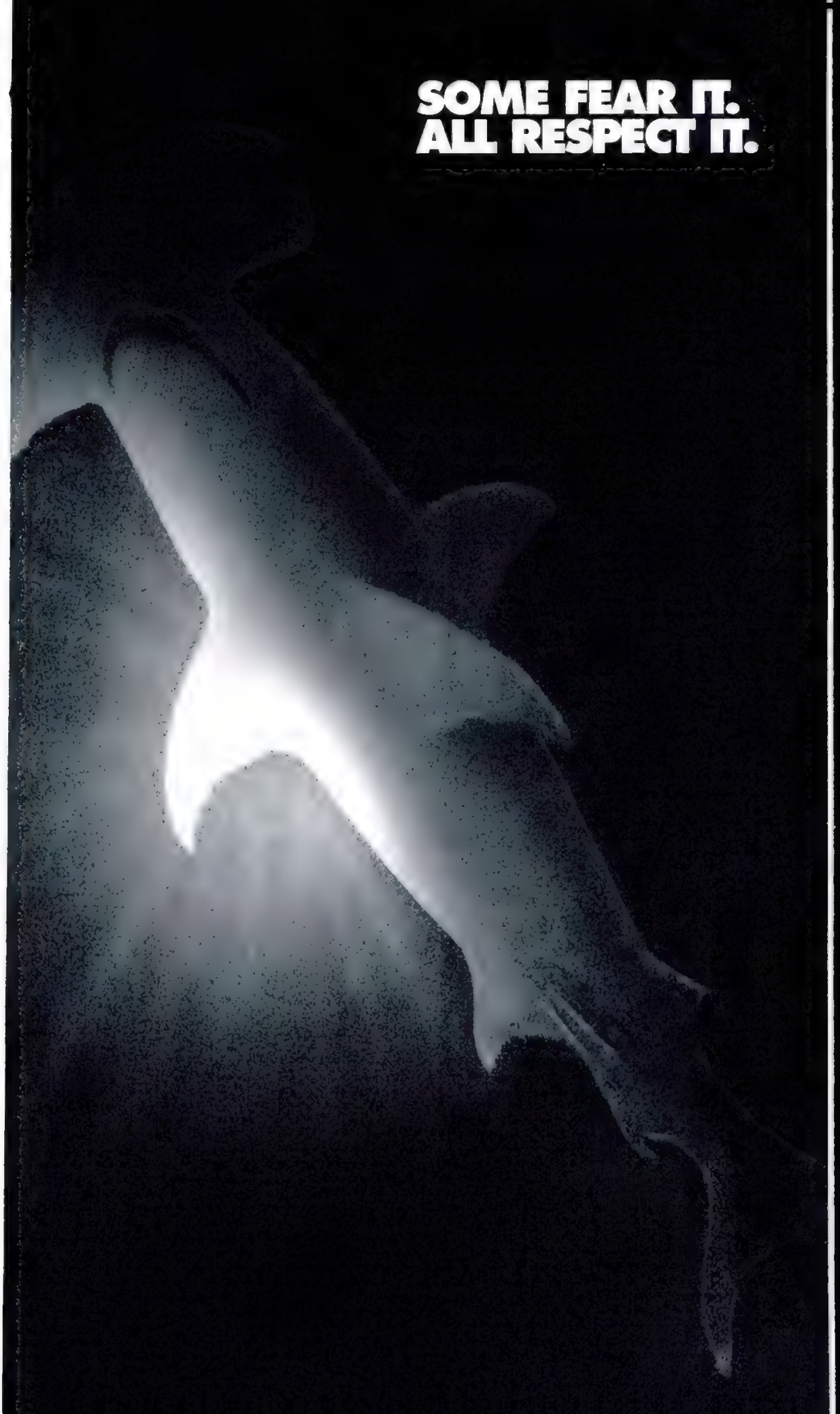
Color mix-ups can also happen when you switch output media (if your printer accepts more than one type of medium). Most colors look a little brighter on paper than on transparencies, because light waves react differently to reflective and transparent surfaces. The color, texture, and gloss of paper stock will also affect your colors. Although printing on letterhead and plain paper is handy (and can cost one-third as much as using coated stock), special coated paper is designed to maintain consistent whites, along with a steady rate of ink absorption and other perks. If you're switching output media, print a test sample to see how the colors change.

What Went Wrong



How We Fixed It

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CIRCLE 141 ON READER SERVICE CARD

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QMS

CIRCLE 259 ON READER SERVICE CARD

Tektronix Phaser II PXe — $4,995

Sharp/Tek 4694 engine-based thermal wax transfer printer with a RISC processor and Adobe PostScript Level 2

A-SIZE:
PS Graphics Speed: 0.6 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 1 min. 34 sec.
CorelDRAW (File): 1 min. 36 sec.

Times Bold
Helvetica Bold
Courier Bold
Palatino Bold

Tektronix Phaser IIsd — $9,995

PC MAGAZINE EDITORS' CHOICE

Sharp/Tek 4684 engine-based dye sublimation printer with a RISC processor and Adobe PostScript Level 2

A-SIZE:
PS Graphics Speed: 0.2 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 4 min. 58 sec.
CorelDRAW (File): 4 min. 48 sec.

Times Bold
Helvetica Bold
Courier Bold
Palatino Bold

Tektronix Phaser III PXi — $9,995

PC MAGAZINE EDITORS' CHOICE

Tektronix 4698 engine-based solid-ink printer with a RISC processor and Adobe PostScript Level 2

A-SIZE:
PS Graphics Speed: 0.2 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 3 min. 34 sec.
CorelDRAW (File): 3 min. 25 sec.

B-SIZE:
PS Graphics Speed: 0.3 gppm
PS WINDOWS APPLICATIONS:
CorelDRAW (Direct): 3 min. 45 sec.
CorelDRAW (File): 3 min. 35 sec.

Times Bold
Helvetica Bold
Courier Bold
Palatino Bold

B-oversize images—is $1,495. The upgrade from 10MB to the maximum 34MB is $3,595.

Adobe PostScript compatibility is provided by PhoenixPage, Phoenix Technologies' Level 1 PostScript interpreter. The 39 resident fonts are from Bitstream.

Output quality, including text, is among the best for thermal wax transfer printers. The 300-dot-per-inch 6613PS produced the smoothest gradients for its technology on the color gradient test. Its process black proved as dark as (or even darker than) pure black to the naked eye. The spectrophotometer indicates why: It shows that the process black shades towards a dark blue, which is actually denser than black. It also did a fine job producing solid hairline rules, rich colors, and the smoothest gradient of white to black for any thermal wax transfer printer.

On the Graphics Speed test, the 6613PS machine managed a score of 0.3 graphics pages per minute with both A- and B-size paper.

PAPER-HANDLING PLUSES

Paper handling is one of the printer's best features. It comes with one tray that handles all paper sizes in stacks of 100 sheets of paper or 50 transparencies.

More important, the printer's image size is notably large: It uses larger-than-normal-size paper with tear-off strips. The strips provide plenty of room for the printer to hold onto the paper while printing. The resulting image areas are 8.1 by 10.6 inches for letter- or legal-size paper, 10.6 by 16.6 inches for B-size paper, and 11.3 by 17.3 inches for B-oversize paper.

CalComp ColorMaster Plus 6613PS

CalComp's coated paper is less glossy than that used by some other printers, and it is coated on both sides so you can print on either side. CalComp says that it's safe to print on both sides of the same page. (It also says that the printer can use nonproprietary 80-pound Quintescence paper.)

According to CalComp, the price of the 6613PS is competitive enough that most dealers do not offer substantial discounts. Considering the quite reasonable price of the printer, that's not a drawback.

The 6613PS has plenty of good points, large image size and high-quality output being chief among them. And if you need the capability of full B-size bleeds, the 6613PS is an obvious choice.

CalComp Inc., *2411 W. La Palma, Anaheim, CA 92803; 800-932-1212, 714-821-2800; fax, 714-821-2709.*

CalComp ColorMaster Plus 6613PS *List price: $6,995; 8MB RAM upgrade, $1,495; 24MB RAM upgrade, $3,595; one-color ribbon, $100; three-color ribbon, $92; four-color ribbon, $85; paper: 300 A-size sheets, $34, 300 B-size sheets, $48, 300 B-oversize sheets, $60; transparencies: 100 A-size sheets, $90. Dimensions (HWD): 20.0 x 20.8 x 23.0 inches. Weight: 62 pounds. Emulations: PhoenixPage PostScript interpreter.*
Circle 471 on reader service card

Price Comparison: A Look at Per-Page Costs

This chart calculates the costs per page for A- and A4-size and B- and A3-size color output, using three- and four-pass ribbons. Total costs were calculated by adding the cost per page for the ribbon plus the cost per page for the paper or transparency.

The Tektronix Phaser III PXI is not represented on this chart because its per-page costs do not directly compare with those of the other systems. A solid-ink printer, the III PXI does not use ribbons but relies on black or color ink sticks. Tektronix estimates a cost of 42 cents per page for 50 percent coverage and 83 cents per page for 100 percent coverage.

Costs per page	A- or A4-size Paper	A- or A4-size Transparency	B- or A3-size Paper	B- or A3-size Transparency
FOUR-PASS RIBBONS				
Brother HT-500PS	$0.60	$1.43	N/A	N/A
CalComp ColorMaster Plus 6613PS	$0.58	$1.37	$0.93	N/A
Mitsubishi DiamondColor Print 300PS	$3.93	$4.33	N/A	N/A
Mitsubishi CHC-S446i ColorStream/DS	$4.80	N/A	N/A	N/A
QMS ColorScript 100 Model 30si	$0.56	$1.52	$0.83	$4.30
Tektronix Phaser IIsd	$2.75	$3.75	N/A	N/A
THREE-PASS RIBBONS				
Brother HT-500PS	$0.51	$1.34	N/A	N/A
CalComp ColorMaster Plus 6613PS	$0.48	$1.27	$0.77	N/A
Mitsubishi DiamondColor Print 300PS	$3.25	$3.65	N/A	N/A
Mitsubishi CHC-S446i ColorStream/DS	$3.40	$5.20	N/A	N/A
QMS ColorScript 100 Model 30si	$0.49	$1.45	$0.71	$4.18
Tektronix Phaser II PXe	$0.49	$1.56	N/A	N/A
Tektronix Phaser IIsd	$2.25	$3.25	N/A	N/A

N/A—Not applicable. The printer does not handle this type of sheet, or the company does not sell sheets in this size.

Mitsubishi Electronics America Inc., Information Systems Division

Mitsubishi DiamondColor Print 300PS

Think of the Mitsubishi DiamondColor Print 300PS ($10,995), from Mitsubishi Electronics America, Information System Division, as a non-PostScript printer that married well. The 300-dot-per-inch dye sublimation printer has a native Mitsubishi mode, but it is paired with a Quintar Q-Script 2000 external controller box that provides PowerPage (Pipeline Associates' Level 1 PostScript interpreter) and 35 fonts.

The printer and the controller each have their own memory, control panels, and power-on switches. When setting up, you first connect the printer to the controller, using the parallel or SCSI ports, and then set the printer with its control panel menus. The controller connects to the outside world through its parallel, serial, AppleTalk, or optional $395 Ethernet or EtherTalk ports.

As with many a marriage, the annoyances in this union are the little problems. For example, the printer's power switch is on the rear left, while the controller's power switch is on the rear right, so turning things on and off is a minor hassle. And if you use the controller as a base for the printer, the controller's LCD is in the shadow of the 300PS's front-mounted paper tray.

Another minor problem is that you have to set some features, such as resolution enhancement, through the controller panel, and others, such as color adjustments, through the printer panel. But as long as you can remember which panel to use for what, both offer intelligible LCD menu messages.

WHAT'S INSIDE

Inside the printer is a Mitsubishi S3600-30U engine, rated at 1.8 minutes per page with a four-color ribbon, and 32MB of RAM (enough to hold a full-page image for multiple printings of a page). The controller box holds 14MB of RAM (a 24MB upgrade from the company costs $2,495), a 40MB hard disk, and a 20-MHz AMD 29000 RISC processor.

Mitsubishi DiamondColor Print 300PS

Mitsubishi Electronics ships the printer in the U.S. with a combination legal-, A-, and A4-size tray, though a 30-sheet A4- and A4 special–size tray is available as a $200 option. The input and output trays each hold up to 15 sheets of the heavyweight coated paper or 15 transparencies.

The printer was slow on the Graphics Speed test, managing only 0.1 graphics pages per minute. It also took last place on the CorelDRAW test. As expected from this technology, scanned photos were nearly indistinguishable from photographic prints, while text quality was less than ideal.

This was the only dye sublimation printer to exhibit a distinct difference between process and pure black; the difference was obvious to the naked eye as well as to the spectrophotometer. Interestingly, pure black is actually gray compared with process black, encouraging the use of a three-pass ribbon in order

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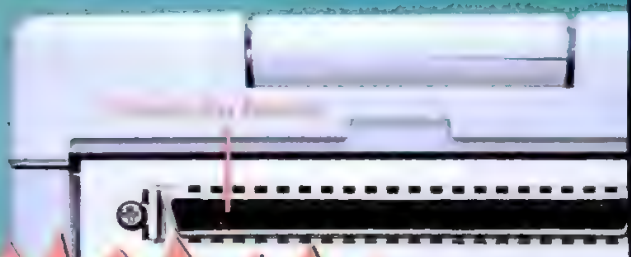

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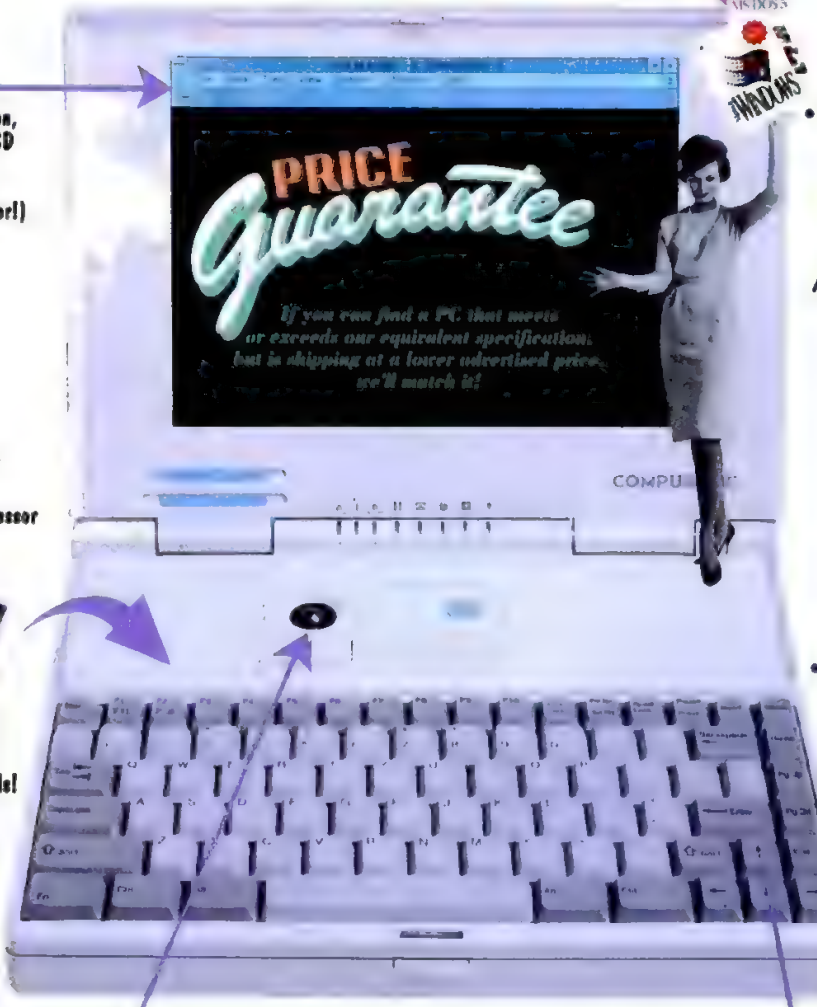

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- Every Compudyne Notebook comes pre-loaded with MS/DOS™ 5.0, Microsoft® Windows™ 3. & Polaris PackRat™ 4.0 Personal Information Manager!
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Result? We're already one of the largest direct PC companies in the country!

Notebook	CPU	RAM (MBs)	HD (MBs)	Battery Life (Hrs)	Price
386SX/20 (while supplies last)	Intel 80386SX-20 MHz Optional 80387SX Last years' model, 6.5lbs	2 standard 16 max	60	1.5+	$999† $37/mo*
386SXL/25 (while supplies last)	386SXL-25 MHz Optional 80387SX This years' model, 5.5lbs	2 standard 4 & 6 options	80	3.5+	$1,399 $52/mo*
386SXL/25	386SXL-25 MHz Optional 80387SX	2 standard 4 & 6 options	80	3.5+	$1,599 $59/mo*
386SL/25	Intel 80386SL-25 MHz 64 K CPU cache Advanced SL power mgm't Optional 80387SX co-processor	2 standard 4 & 6 options	80	3.5+	$1,799 $67/mo*
486SX/25	Intel 80486SX-25 MHz Built-in 8K CPU cache	4 standard 8 & 20 options	80	2.5+	$1,999 $74/mo*
486DX/33	Intel 80486DX-33 MHz Built-in 8K CPU cache	as above	130	2.5+	$2,899 $107/mo*

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*Leasing through Leasing Group, Inc, payments based on 36 month open-end rate. **Must be returned as-new in the original packaging. ™/® trademarks are the property of their registered owners. †Last years' model. Actual photo not shown. Actual weight 6.5lbs. Trackball not included. Most specs different from current model

CIRCLE 132 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

Color PostScript Printers

Products listed in order as reviewed

■ = YES □ = NO

	Brother HT-500PS	CalComp ColorMaster Plus 6613PS	Mitsubishi DiamondColor Print 300PS	Mitsubishi CHC-S446i ColorStream/DS	QMS ColorScript 100 Model 30si	Tektronix Phaser II PXe
List price	$4,995	$6,995	$10,995	$11,900	$9,995	$4,995
General Characteristics						
Engine type	Thermal wax transfer	Thermal wax transfer	Dye sublimation	Dye sublimation	Thermal wax transfer	Thermal wax transfer
Model	Mitsubishi G370	CalComp 6613	Mitsubishi S3600-30U	Shinko CHC-S446i	Mitsubishi G650	Sharp/Tek 4694
Maximum resolution (dpi)	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300
Controller	Brother HT-500PS	CalComp 6613	Quintar Q-Script 2000	Mitsubishi i-PCB	QMS 30si	Tektronix 4694PXe
RISC processor	None	16-MHz i960KB	20-MHz AMD 29000	25-MHz AMD 29050	None	16-MHz AMD 29000
Total installable memory	21MB	34MB	32MB (printer), 38MB (controller)	38MB	12MB (included)	8MB
Standard or proprietary upgrades	Standard	Proprietary	Standard (Mac-style)	Standard	N/A	Proprietary
Printer-specific Microsoft Windows 3.1 driver available	■ (on request)	■ (included)	■ (included)	■ (included)	■ (via BBS and in Windows 3.1)	■ (included and in Windows 3.1)
Interfaces						
Parallel/serial port	■■	■■	■■	■■	■■	■■
AppleTalk port	■	■	■	■	■	■
SCSI port	■ (for hard disk)	■ (for hard disk)	□	■	■ (for hard disk)	□
Automatic interface switching	■	■	■	■	□	■
Simultaneously active ports	□	■	□	■	□	■
Paper Handling						
Accepts plain paper	□	□	□	□	□	□
Printable area (inches) on letter-size paper	8.1 x 9	8.1 x 10.6	8.1 x 9	8.2 x 9.3	8.1 x 8.9	8.1 x 8.8
Printable area (inches) on legal-size paper	8.1 x 12	8.1 x 10.6	8.1 x 11	8.5 x 12.3 (on super A–size paper)	N/A	8.1 x 10.8
Printable area (inches) on B-size paper	N/A	10.6 x 16.6	N/A	N/A	10.6 x 14.9	N/A
Duplexing	□	■	□	□	□	□
Fonts and Features						
Number of Type 1 fonts supported	35	39	35	35	35 (plus 4 via software)	17 (39 via firmware upgrade)
Automatic emulation switching	■	■	□	■	■ (via software)	■ (via software)
Pantone-certified	□	■	□	□	■	■
Color separations	■	■	□	■	■	□
Controls						
Control panels	■	■	■ (on printer and controller)	■	■	□
LCD	■	■	■ (on printer and controller)	■	□	N/A
Number of characters	32	32	64 (on printer), 16 (on controller)	16	N/A	N/A
Control-panel buttons:						
Color separation	■	■	□	□	□	N/A
Paper size	■	□	□	□	□	N/A
Image size	□	■	□	□	■	N/A
Ribbon type	□	■	□	□	□	N/A
Customer Support						
Toll-free technical support	□	■	■	□	□	■
Telephone support hours (eastern time)	9:00–7:30 M–F	8:30–7:30 M–F	11:00–7:00 M–F	9:30–5:30 M–F	9:00–4:00 M–F	9:00–8:00 M–F
24-hour BBS	□	■	■	□	■	□
Warranty (parts and labor)	1 year	1 year	1 year	3 months	3 months	1 year, or 90 days on-site

N/A—Not applicable: The product does not have this feature

	PC EDITORS' CHOICE	PC EDITORS' CHOICE
	Tektronix Phaser IIsd	**Tektronix Phaser III PXi**
	$9,995	$9,995
	Dye sublimation	Solid ink
	Sharp/Tek 4684	Tektronix 4698
	300 x 300	300 x 300
	Tektronix 4684SD	Tektronix 4698 PXi
	24-MHz AMD 29000	24-MHz AMD 29000
	64MB	18MB
	Proprietary	Proprietary
	■ (included and in Windows 3.1)	■ (in Windows 3.1)
	■■	■■
	■	■
	■ (for hard disk)	■ (for hard disk)
	■	■
	■	■
	□	■
	8.1 x 8.8	8.1 x 10.5
	8.1 x 10.8	8.1 x 13.5
	N/A	10.6 x 16.5
	□	□
	39	39
	□	■ (via software)
	■	■
	□	□
	□	■
	N/A	■
	N/A	48
	N/A	□
	N/A	□
	N/A	□
	N/A	□
	■	■
	9:00–8:00 M–F	9:00–8:00 M–F
	□	□
	1 year, or 90 days on-site	1 year, or 90 days on-site

ENDS

to get the darkest black.

The 300PS is an acceptable choice for users who want photographic-quality output, but not the best. Although its output for continuous-tone images is gorgeous, it is matched—and bettered for text—by the slightly faster, less expensive ($9,995) Tektronix Phaser IIsd.

Mitsubishi Electronics America Inc., Information Systems Division, *5665 Plaza Dr., Cypress, CA 90630; 800-843-2515, 714-236-6352; fax, 714-236-6172.*

Mitsubishi DiamondColor Print 300PS *List price: $10,995; 24MB RAM upgrade (for controller), $2,495; 30-sheet (paper or transparency) A4- and A4 special–size paper cassette, $200; one-color ribbon, $280; three- or four-color ribbon, $205; Ethernet TCP/IP or EtherTalk port, $395; paper: 100 letter-size sheets, $120, 100 legal-size sheets, $170; transparencies: 100 letter-size sheets, $160, 100 legal-size sheets, $200. Dimensions (HWD): 11.3 x 17.0 x 17.1 inches. Weight: 59.5 pounds. Emulations: Pipeline PowerPage PostScript interpreter, Mitsubishi.*
Circle 472 on reader service card

Mitsubishi International Corp.

Mitsubishi CHC-S446i ColorStream/DS

What do you get when you combine a Shinko 300-dot-per-inch dye sublimation engine with a Mitsubishi International Corp. controller? The answer is the Mitsubishi CHC-S446i ColorStream/DS, a printer that includes only a Shinko native emulation in its $10,950 base price. To turn this into an Adobe PostScript printer, you need a $950 cartridge with Pipeline Associates' PowerPage Level 1 PostScript interpreter, which includes 35 fonts and brings the total cost to $11,900.

The ColorStream/DS is the first of the i-Printers from Mitsubishi International Corp. (not to be confused with Mitsubishi Electronics America, which is also represented here), the North American distributor for Shinko Electric Industries Co. The *i* stands for *intelligent* and refers to the ability to change emulations and add fonts by plugging a card into one of the printer's two card slots. The Level 1 PostScript card is the only one available now, but the company promises a Level 2 card and font options before the end of the year.

In addition to the CHC-S446i engine (rated at 6.7 minutes per page with a four-color ribbon), the printer includes a 25-MHz AMD 29050 RISC processor and 14MB of RAM, expandable to 38MB with standard SIMMs.

On the Graphics Speed test, the printer matched the Tektronix Phaser IIsd, handling 0.2 graphics pages per minute. It was the second-slowest on our CorelDRAW test. Output quality was typical for this class, with photographic-quality reproduction of scanned photos and less-than-ideal text.

As with the other dye sublimation printers reviewed here, the ColorStream/DS is essentially A-size, though the available paper sizes are A and super A (an unusual 8.7 by 14 inches). The input and output trays can each handle up to 50 sheets of either transparencies or the heavyweight coated paper. (Another 50-sheet letter- and super A–size cassette is a $195 option.)

Somewhat unusually, the printer needs different ribbons for paper and transparencies, and it supports only three-pass ribbons for the latter. This makes it clumsy to use—and probably the wrong choice—if you regularly switch between the two media. In the plus column, the control panel menus provide straightforward choices for setting paper size, disabling resolution enhancement, and other configuration options.

Even though the $10,000 street price for the ColorStream/DS is notably higher than the $8,900 street price of the IIsd—the least expensive of the dye sublimation printers—the ColorStream/DS remains a good choice for users who want photographic-quality output. And it's the only dye sublimation printer to offer easy upgradability through emulation and

Mitsubishi CHC-S446i ColorStream/DS

If you're thinking of buying an HP PaintJet XL300, give us a week to change your mind.

Introducing the new Seiko Instruments Personal ColorPoint PSE.

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SII
Seiko Instruments

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CIRCLE 114 ON READER SERVICE CARD

font cards—a feature that may become important as cards become available.

Mitsubishi International Corp., *701 Westchester Ave., White Plains, NY 10604; 914-997-4999; fax, 914-997-4976.*

Mitsubishi CHC-S446i ColorStream/DS *List price: $11,900 (with $950 PostScript cartridge); 24MB RAM upgrade, $800 per 8MB SIMM; additional 50-sheet (paper or transparency) letter- and super A–size paper cassette, $195; one-color ribbon, $320; three-color ribbon: for coated paper, $210, for transparencies, $330; four-color ribbon, $280; paper: 100 letter-size sheets, $130, 100 super A–size sheets, $190; transparencies: 100 letter-size sheets, $190, 100 super A–size sheets, $240. Dimensions (HWD): 12.0 x 15.3 x 24.4 inches. Weight: 59.5 pounds. Emulations: Pipeline PowerPage PostScript interpreter, Shinko CHC-S445.*
Circle 473 on reader service card

QMS Inc.

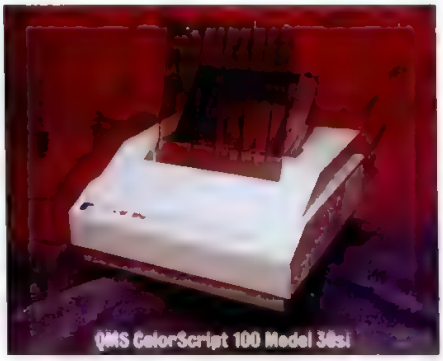
QMS ColorScript 100 Model 30si

The QMS ColorScript 100 Model 30si ($9,995) is the latest incarnation of the ColorScript 100, first introduced in 1987. The Model 30si's new chief attraction is B-oversize paper handling; added charms include 12MB of RAM (base and maximum) and the brilliant colors typical of thermal wax transfer printers. While the Model 30si is not the standout that earlier ColorScript 100s were, it remains a solid choice.

The Model 30si is expensive for its capabilities: sold directly to end users, the Model 30si costs $3,000 more than the CalComp ColorMaster Plus 6613PS, for example. But with the introduction of the $7,995 high-end, B-oversize QMS ColorScript 230 (set to debut by the time you read this), it's a good bet that the Model 30si's price will drop significantly.

The system uses a 300-dot-per-inch Mitsubishi G650 engine, which is rated at 1 minute per page with a four-pass ribbon, and a QMS 30Si controller. Rather than a RISC processor, the unit has a 16.67-MHz Motorola 68020. Still, performance was impressive. With A-size paper, the unit's Graphics Speed test score of 0.5 graphics pages per minute with a four-pass ribbon was second only to that of the Tektronix Phaser II PXe with a three-pass ribbon. And its 0.6-gppm B-size mode score equaled the II PXe's A-size mode score.

Output features crisp hairline rules and text, sharp colors, and suitably dark blacks. There was some banding on color gradient and vertical gray gradient tests, though, and you can easily tell the difference between process and pure black. The spectrophotometer confirms this; it shows process black leaning toward the cyan area on the color gamut.


QMS ColorScript 100 Model 30si

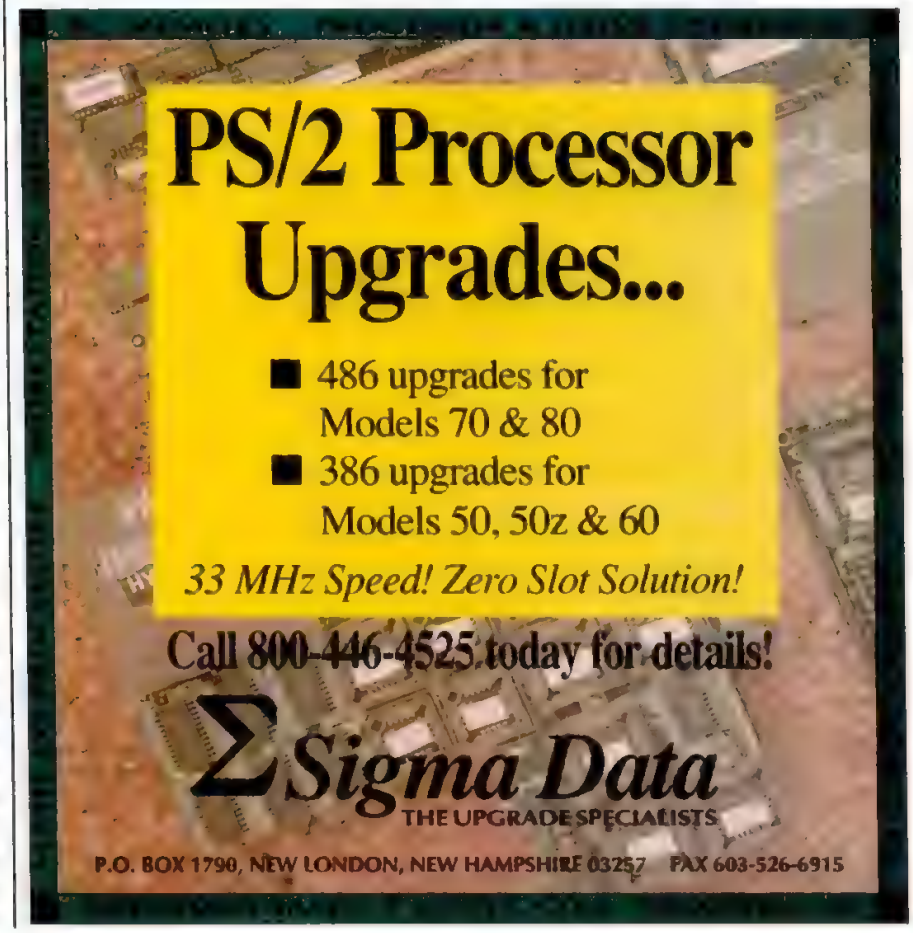
The printer uses Adobe PostScript Level 1, with 35 fonts built-in; a software utility brings the total to 39 fonts. Also, the printer comes with QMS's downloadable, software-based HPGL emulation.

A SIZE FOR ALL SEASONS

The unit's main feature is the ability to handle up to B-oversize (11.8- by 19.3-inch) paper. Maximum image size is 11.3 by 17.2 inches, for the full-bleed pages graphic artists need.

The base configuration comes with three paper trays: for letter- and A4-size, B- and A3-size, and B-oversize paper. Each cassette holds 150 sheets of paper or 10 transparencies. The output tray holds 50 sheets of paper or transparencies. Optional second trays in each size range in price from $120 to $190. The paper is a special smooth but uncoated stock and could almost pass for copy paper. You can print on either side, but not on both sides, of a page.

Setting up the Model 30si requires flicking some switches on the back to designate paper size and ribbon type. The procedure is straightforward but easy to forget, and the switches are difficult to reach. Much better would be automatic



CIRCLE 213 ON READER SERVICE CARD

sensing of paper size and ribbon.

Consider the Model 30si if you want thermal wax transfer technology with B-oversize capability. And while the underlying design for the Model 30 series is no longer as impressive as it was even two years ago—more companies have entered the fray, offering other technologies and easier-to-use printers—the Model 30si remains a reasonable choice, especially at the expected lower price.

QMS Inc., *One Magnum Pass, Mobile, AL 36618; 800-631-2692, 205-633-4300; fax, 205-633-0116.*

QMS ColorScript 100 Model 30si *List price: $9,995; SCSI hard disks: 20MB RAM, $995, 45MB RAM, $1,495; additional 150-page, 10-transparency letter- and A4-size paper cassette, $120; additional 150-page, 10-transparency B-size paper cassette, $120; 150-page, 10-transparency B-oversize paper cassette, $190; one-color ribbon, or three- or four-color A- or B-size ribbon, $90; three- or four-color ribbon for B-oversize paper, $100; paper: 2,000 A- or A4-size sheets, $125, 2,000 A3- or B-size sheets, $220; 1,000 B-oversize sheets, $260; transparencies: 200 A- or A4-size sheets, $205, 90 A3- or B-size sheets, $325. Dimensions (HWD): 19.0 x 20.7 x 22.2 inches. Weight: 81.5 pounds. Emulations: Adobe PostScript, HPGL.*
Circle 474 on reader service card

Tektronix Inc., Graphics Printing & Imaging Division

Tektronix Phaser II PXe
Tektronix Phaser IIsd
Tektronix Phaser III PXi

Gorgeous output links all three of Tektronix's new offerings, each representative of a different technology. The Tektronix Phaser II PXe ($4,995) offers the brilliant hues of thermal wax transfer technology for an entry-level price. The Tektronix Phaser IIsd ($9,995), based on dye sublimation technology, is capable of photographic-quality output. The Tektronix Phaser III PXi ($9,995) uses solid ink and will be, for many, the best choice for a PostScript color printer.

The three printers have much in common, including Tektronix controllers, an AMD 29000 RISC processor (running at 16 MHz in the II PXe and at 24 MHz in the IIsd and III PXi), and the ability to accept input from multiple ports at once. The IIsd and the III PXi offer a SCSI port for external third-party hard disks.

As was the case last year, the Tektronix printers were the only color printers to come with Adobe PostScript Level 2. The IIsd and III PXi have 39 fonts standard; the II PXe comes with 17 fonts, with the full 39 available as a $595 option. The II PXe and III PXi also include HPGL and emulation switching.

PHASER II PXe

The II PXe, with a typical street price of about $4,500 to $4,750, is Tektronix's entry-level presentation printer for business users. The printer comes with only 4MB of RAM, upgradable to 8MB with a $595 proprietary SIMM.

The II PXe is built around the same

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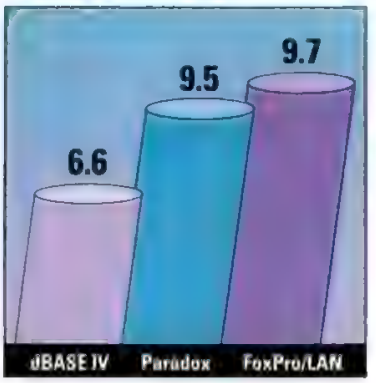

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300-dot-per-inch Sharp/Tek 4694 engine as the one in the Phaser II PXi ($7,995) which we reviewed last year, though the II PXi has a faster 24-MHz RISC processor on its controller. The II PXe offers paper-handling features similar to those of the II PXi and the IIsd. The printer comes with one of two paper cassettes: for U.S. letter- and legal-size paper or for the European equivalents. The cassettes hold 100 sheets of treated paper or 50 transparencies. (Second cassettes in either size are $99 options.)

The image are a—for the IIsd as well as for the II PXe—is 8.1 by 8.8 inches for letter-size paper and 8.1 by 10.8 inches for legal-size paper. The maximum image size is designed for Tektronix's perforated legal-size paper and transparencies, which reduce to 8.5 by 11 inches after removing the tear-off strips.

The II PXe uses monochrome or three-pass ribbons (the higher-end II PXi can use four-pass ribbons); the rated three-pass speed is 0.8 minutes per page. On PC Magazine Labs' Graphics Speed test, the printer managed a speedy 0.6 graphics pages per minute. It zipped through our CorelDRAW test in top place. (Remember, though, that its competitors used four-pass ribbons.)

One important strength for the II PXe is its ease of use. The II PXe uses one ribbon for all paper sizes and automatically adjusts for size. The front panel offers only status lights, but there is no need for control panel or menu settings. The IIsd shares all of these features.

As you might expect from the three-color ribbon, black bitmapped images had a sepia tinge. A moire effect and some unevenness on the color gradient test are more troubling. The printer produced appropriately vibrant colors, however, and is well suited to its intended purpose of presentation graphics.

PHASER IIsd

If you need photographic quality, then dye sublimation printing is your technology, and the Phaser IIsd—with a street price of roughly $8,900—may well be the right printer for you.

Tektronix Phaser IIsd, Tektronix Phaser III PXi, Tektronix Phaser II PXe

The IIsd comes with 16MB of RAM, expandable to 64MB. Proprietary SIMMs cost from $595 for a 4MB SIMM to $5,985 for three 16MB SIMMs. As mentioned, the IIsd shares standard and optional paper-handling features with the II PXe, though the IIsd cassettes are limited to 50 sheets of paper because of thicker paper stock.

The IIsd's primary distinguishing feature is its print engine, the 300-dpi Sharp/Tek 4684. The rated speed is 4.1 minutes per page for four-pass color. On PC Labs' tests, the printer produced a score of 0.2 gppm and was only moderately slow on the CorelDRAW test.

The Tektronix Phaser III PXi produces some of the best-quality output of any color PostScript printer.

Most important, the IIsd's dye sublimation output justifies both the wait and the high cost of consumables (another dye sublimation trait). The Photofine resolution enhancement technology helps produce surprisingly dark and thick hairline rules, as well as the best quality text of all the dye sublimation printers. Full-color printed photos are indistinguishable from photographic prints, at least to the naked eye. If you need high-quality, continuous-tone images, the Phaser IIsd is worth its price.

PHASER III PXI

The Phaser III PXi (with a street price of $8,600 to $9,200) produces some of the best-quality output of any color PostScript printer—and it creates it on standard paper, paper towels, and just about any surface that fits through the printer.

The III PXi is an upgrade of the III PXi that won an Editors' Choice last year. What earns it another look this year is the addition of Finepoint, a proprietary resolution enhancement technology.

With Finepoint, the III PXi is able to print pictures that approach photographic quality. Results on all PC Labs' quality tests were superb. From 5 feet away, the output looks like a continuous-tone image, though from normal reading distance, you can see the differences. (If you already own a III PXi printer that doesn't include Finepoint, you can add it via a $295 firmware upgrade.)

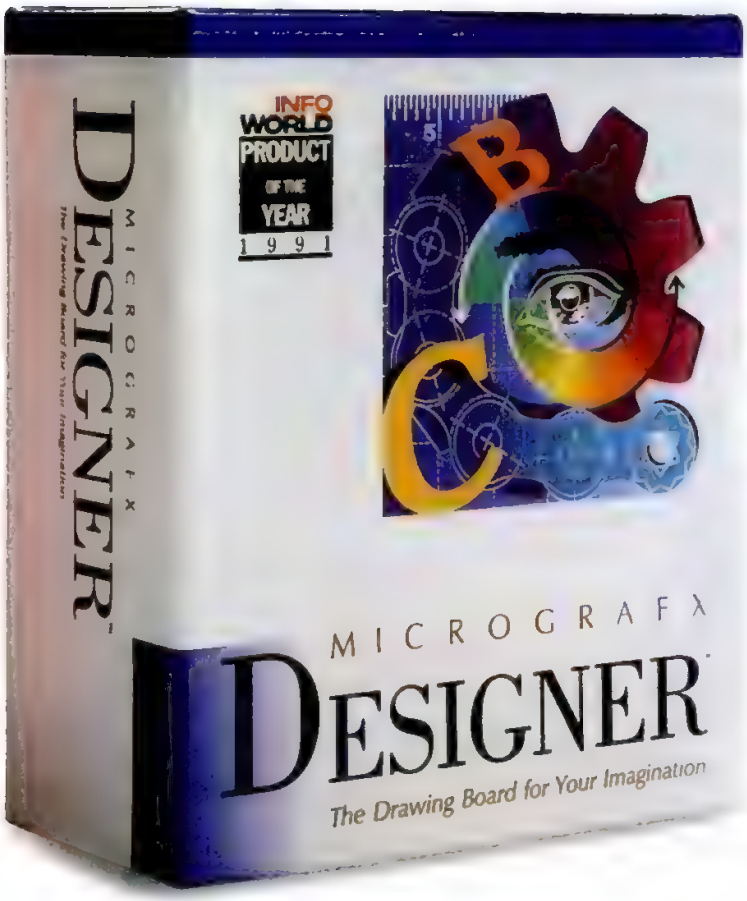
One feature that makes the III PXi preferable to the IIsd for most users is that it also handles other types of color printing well. It can print on virtually anything, thanks to what Tektronix calls *phase change technology*. The III PXi uses solid sticks of ink; the printer melts the ink and sprays it onto the page (much like a standard ink jet). But there is no smudging and no need for special paper.

The printer can handle just about any size paper up to B-oversize (12 by 18 inches). It comes with a built-in manual feed and a front-loading, letter-size paper cassette. The standard cassette, optional $125 letter-size cassette, and optional $150 multipurpose cassette (for letter-size to B-oversize paper) handle 200 sheets of paper or 100 transparencies. Maximum image size matches paper size minus a 0.2-inch margin on the left, right, and bottom, and a 0.3-inch margin on top.

The 300-dpi Tektronix 4698 engine is rated at 2 minutes per page for color printing. On PC Labs' tests, the printer managed a result of 0.2 gppm (A-size) and 0.3 gppm (B-size), and turned in respectable times on the CorelDRAW test.

The basic configuration of 10MB of RAM is expandable to a maximum of 18MB in increments of $595 for 4MB of Tektronix's proprietary SIMMs.

With this trio of printers, Tektronix has clearly made an effort to cover every color output need. Although no one printer can do the job completely, the III



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Circle 475 on reader service card

EDITORS' CHOICE ▶ Tektronix Phaser IIsd *List price: $9,995; one 4MB SIMM, $595; one 16MB SIMM, $1,995; two 16MB SIMMs, $3,990; three 16MB SIMMs, $5,985; additional 50-sheet (paper or transparency) letter- and legal-size paper cassette or A4- and A4 special–size paper cassette, $99; one-color ribbon, $200; three-color ribbon, $175; four-color ribbon, $225; Ethernet TCP/IP port, $1,495; EtherTalk port, $695; paper: 200 letter- or A4-size sheets, $100, 200 legal- or A4 special–size sheets, $200; transparencies: 50 letter- or A4-size sheets, $75, 50 legal- or A4 special–size sheets, $100; transfer roll holder, $50. Dimensions (HWD): 14.3 x 17.2 x 27.1 inches. Weight: 73 pounds. Emulations: Adobe PostScript Level 2.*

Circle 476 on reader service card

EDITORS' CHOICE ▶ Tektronix Phaser III PXi *List price: $9,995; 4MB RAM upgrade, $595; additional 200-page, 100-transparency letter-size paper cassette, $125; 200-page, 100-transparency letter-size–to–B-oversize paper cassette, $150; eight black ink sticks, $129; eight color ink sticks, $75; Ethernet port, $1,495; transparencies: 100 letter- or A4-size sheets, $125; media laminator, $995. Dimensions (HWD): 12.8 x 23.2 x 32.8 inches. Weight: 90 pounds. Emulations: Adobe PostScript Level 2, HPGL.*

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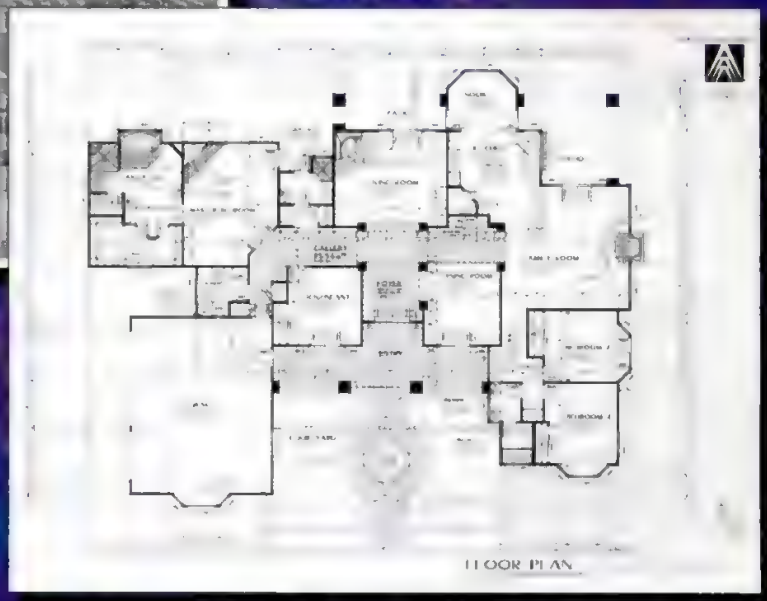

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True Colors Shine Through

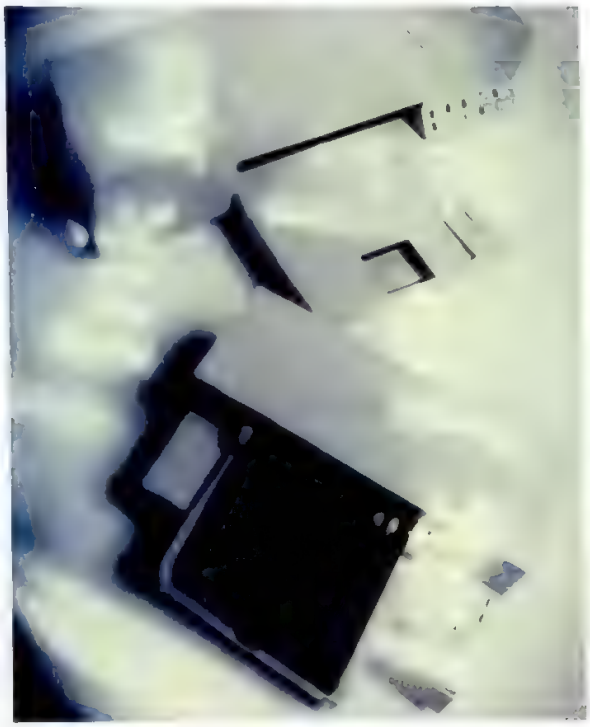
Last year ink jets got faster. This year they get colorful. Four of the seven printers in this review provide high-quality color at low-end prices, from just under $1,000 to around $3,500.

by Carol Ellison

The big news in ink jet technology last year was speed. The Canon Bubble Jet Printer BJ-300, its sibling, the BJ-330, and the IBM ExecJet Printer we reviewed in "Ink Jets: Getting Faster, Getting Better" (November 26, 1991) racked up close to 200 characters per second in draft mode and over 100 cps in quality mode.

This year, the excitement is over affordable, spectacular color. We review four new color entries here: the Canon Bubble Jet Printer BJC-800 ($2,795) and, from Hewlett-Packard, the HP DeskJet 500C ($779), the HP DeskJet 550C ($1,099), and the HP PaintJet XL300 ($3,495).

While the Canon BJC-800, HP DeskJet 500C, and HP DeskJet 550C all provide quality color output for business graphics and desktop publishing needs, the Pantone-certified HP PaintJet XL300's output is simply breathtaking for a printer of this class. At $4,995 (including the soon-to-be-available PostScript option and 6MB of RAM), it offers publishers a thrifty alternative to solid ink and thermal wax transfer printers that can cost up to twice as much. Both the PaintJet XL300 and the BJC-800 also support paper widths as large as 11 by 17 inches.



LOW COST, HIGH QUALITY

Of course, not everyone requires color output. Many people just want the essentials every ink jet offers: quiet operation and letter-quality text output on plain paper for less than the price of a laser printer.

Excluding the color-capable units, the ink jets in this review range in price from $499.95 to $599. Other monochrome ink jets brand new this year (and just reviewed in "Small, Light, and Capable: Portable Printers Deliver a Triple Play" in our August issue) are the Brother HJ-100i

Photograph by Scott Wippermann

($499), the DECmultiJET 1000 ($329), the Kodak Diconix 180si ($399), and the Editors' Choice–winning Kodak Diconix 701 ($549). The Canon BJ-10ex, a slightly revised version of the venerable BJ-10e, costs $499. (Because we so recently looked at these five printers, we do not review them again here.)

With their affordable price tags and fine-looking output, ink jet printers have become popular in small offices and home businesses. In fact, they represented the fastest-growing segment of the printer industry last year, according to research firm BIS Strategic Decisions.

Thanks to their lightweight, compact printing mechanisms, ink jets also made up four-fifths of the 250,000 portable printers sold last year. By offering options like cut-sheet feeders, many of those portables could be equipped for desktop duty in addition to on-the-road work, adding to their appeal for small businesses on tight budgets.

This year's portables are even better equipped to function in both environments; for example, the 4.3-pound Canon BJ-20 we review here includes a 50-page sheet feeder as standard equipment, and the 5.6-pound Kodak 701 reviewed in August builds in a 30-page sheet feeder. The Kodak 701 also gets points for an elegant, space-saving design. The 2.9-pound Kodak 180si is built to accept continuous form paper via its internal tractor-feed mechanism. None of these three is as light as the 2.2-pound Citizen PN48 Notebook Printer (a thermal fusion printer that's still the best choice for strictly portable use), but they are more practical for the desktop.

The Royal CJP 450 from Royal Consumer Business Products is also compact enough to serve as a portable, but unlike the Canon BJ-20 and the Kodak 701, it doesn't provide a battery option.

COSTLY CONSUMABLES

While ink jets offer a cost-effective entrée to good-looking print, consumable costs can be high. To help avoid problems like clogged print heads and messy ink refills that plagued early ink jets, most products now use an ink cartridge/printhead combination. (For this review, that was true of all but the Canon BJC-800.) This does, however, raise the cost per page of supplies since the printheads must also be replaced whenever the ink cartridges go dry.

Expect to spend about 4 cents per monochrome text page with the PaintJet XL300, and 6 cents per monochrome text page with the BJC-800. The others cost about 10 cents per monochrome page. The BJC-800 and the XL300 round out to about 60 cents per page for plain-paper color output, assuming 50 percent coverage. The DeskJets are slightly more pricey—just over 75 cents per page.

Although the printers reviewed here are sold as plain-paper models (in fact, you shouldn't use the DeskJets' black ink cartridges on anything but plain paper), coated paper still offers the best results when printing color graphics. Both color- and black graphics appeared faded on plain paper used with the Canon BJC-800. The HP offerings' output stands up well on plain paper, but coated paper increases the depth and vibrancy of the colors. Of course, coated paper will raise your cost per page a few cents. Still, it's an investment you'll want to make if graphics printing is important to you.

THE SMUDGE FACTOR

Most ink jets provide resolution—360 dots per inch for the Canon units and 300 dpi for the others—at least as good as the majority of laser printers. But even with their high resolutions, ink jets can't quite match laser text output because ink spreads as it is absorbed by paper, and that can lead to jaggies. (For more information on how these seven ink jets work, see the sidebar "Bubble Jet Printing: Sizzle, Steam, and Squirt.")

Additionally, most ink jets use water-soluble inks, and smudging can be a problem, particularly if printer pages are removed from the print tray before the ink is completely dry. Even after the ink dries, moist finger tips or condensation from a soda can that accidentally gets set down on a page can destroy the appearance. Oil-based inks don't eliminate the problem completely, but they help minimize it. These are beginning to inch into the market. Among the printers reviewed in this roundup, the DeskJet 500C and DeskJet 550C use oil-based black ink cartridges.

The printers in this review all experienced some problems with smearing (although smearing is reduced with coated paper). The PaintJet XL300 was the only one to have serious problems with smudging, however.

PERFORMANCE TEST RESULTS

None of the printers we reviewed in the August issue or here can best the Text Speed test results posted by the Canon BJ-300, Canon BJ-330, or IBM ExecJet. Graphics Speed test scores for those in this roundup, however, are noteworthy;

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HIGHLIGHTS

Ink Jet Printers

THE BIG NEWS in ink jets is enticing and affordable color, with offerings like the Canon BJC-800 and the HP DeskJet 500C, DeskJet 550C, and PaintJet XL300 all priced below $3,500.

ALL FOUR provide color output suitable for business graphics and desktop publishing, but the $3,495 PaintJet XL300 stands out for its excellence. With Pantone certification and PostScript and network options, the printer can be an effective alternative to higher-end, more costly technologies.

THE PAINTJET XL300 provides its quality color output at the cost of speed, but the color-capable DeskJets proved fastest overall.

INK JETS are also the printers of choice for portables. Systems like the Canon BJ-20 and Kodak Diconix 701 (reviewed in our August issue) are suited to life both on the road and on the desktop, offering high-quality text output and sheet feeders as standard features.

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the HP DeskJets, for example, handled just a little under 2 graphics pages per minute. But when it comes to text output, these ink jets are not the office workhorses that laser printers are.

In PC Magazine Labs' printer performance tests, the HP DeskJet 500C and the DeskJet 550C were the best performers overall on the Text Speed tests (in both draft mode and quality mode) as well as the Graphics Speed test. They printed 71 cps and 73 cps, respectively, in quality mode. On our Graphics Speed test, they printed 1.9 pages per minute and 1.7 pages per minute, respectively. The DeskJets also displayed outstanding performance on our Windows tests—a testament to their well-thought-out Windows drivers. A faulty Windows driver was responsible for the Canon BJC-800's trailing scores on two out of three Windows tests.

The PaintJet XL300 produces its vastly superior color quality at the cost of speed. It was the slowest of all the ink jets on the Text Speed and Graphics Speed tests, performing at less than half the speed of the Canon BJC-800 color ink jet printer.

Digital Equipment Corp.'s DEC-multiJET 2000 proved to be the fastest monochrome offering.

FUTURE OFFERINGS

HP isn't stopping its ink jet line with the three products reviewed here. By the time you read this, the company will have launched its portable ink jet entry, the 300-dpi HP DeskJet Portable Printer ($599). Lexmark will also be offering a monochrome ink jet, the 360-dpi IBM 4070 IJ, that will sell for $599 with a 50-page sheet feeder.

Other ink jet units still in development at review time included Mitsui Comtek's $2,495 PostScript-capable PC version of its BP36-70 Macintosh product, and Smith Corona's $499 Coronajet 200j.

Pacific Data Products' 360-dpi C-size ProTracer Personal Printer/Plotter ($1,499) began shipping too late for inclusion in this review.

One of the more dramatic developments in the industry since last year's printer issue has been the consolidation of Canon's product marketing and development efforts in the United States under an autonomous subsidiary of Canon Inc. and Canon USA Inc. While Canon and Canon USA will continue their relationships with OEM customers, the new subsidiary, called Canon Computer Systems, exists solely to market Canon's own products more aggressively in the United States. Expect plenty of competitive ink jet products in the years to come.

The ink jets available now offer something for everyone. If you need an inexpensive plain-paper text printer, a unit you can take on the road, or a color desktop printer to run quality desktop publishing and graphics applications, this year's ink jet roundup and our review of portable printers in our August issue are the places to look.

PC MAGAZINE

EDITORS' CHOICE

- **HP DeskJet 550C**
- **HP PaintJet XL300**

Exciting, affordable color output earns Editors' Choice honors for two Hewlett-Packard offerings: the HP DeskJet 550C and the HP PaintJet XL300. At $1,099, the DeskJet 550C is a low-end color solution for business users and desktop publishers. The PaintJet XL300 ($3,495) is a large-media solution that can also be used for higher-end publishing applications.

With its upcoming PostScript option and 6MB of RAM installed, the PaintJet XL300's $4,995 list price is as much as half the price of some higher-end thermal wax transfer and solid ink printers. Network interface options, automatic emulation sensing, and automatic switching among ports suit the PaintJet XL300 for use in a shared environment.

Unlike the Canon Bubble Jet Printer BJC-800, both the HP units offer the advantage of high-quality color output on plain paper. Coated paper enhances the depth and vibrancy of color output for the DeskJet 550C. (The 550C's major drawback here is that black ink and coated paper don't mix.) With the PaintJet XL300, color output on coated paper is breathtaking.

The price you'll pay for the PaintJet XL300's high-quality output is in speed and smearing. The system turned in the most lackluster performance on our tests, and was especially prone to smudging. But patience and a dry environment will produce results that no other color ink jet reviewed here can match.

If speed is more important than the highest-quality color output, the DeskJet 550C's brisk pace and good output will satisfy.

KUDOS TO KODAK

Today, many monochrome ink jets are doing double duty as both small-footprint desktops and portable printers. In that arena, none of the printers we look at here beats the Kodak Diconix 701 Printer, which earned Editors' Choice in our review of portable printers in our August issue.

The Kodak 701 is well suited for desktop work and sports impressive

Canon Computer Systems Inc.

Canon Bubble Jet Printer BJ-20
Canon Bubble Jet Printer BJC-800

BY MITT JONES

Two Canon printers—the $699 Bubble Jet Printer BJ-300 and the $849 BJ-330—took top honors in last year's annual printer issue, thanks largely to their remarkable performance—200 characters per second—on our tests. The most recent additions to the Canon ink jet line (now marketed by the newly formed

paper-handling capabilities for a portable: It offers a built-in cut-sheet feeder. The 300-dpi Kodak 701 also distinguished itself with high-quality text output and fast performance. Finally, since the paper input and output stacks sit on top of the unit, the printer requires virtually no clearance in front or behind. That makes it an appropriate choice when space is an issue. The unit weighs 7 pounds with battery and AC adapter/charger, so it's not the best choice for travelers constantly on the move. But it's perfect for an extended business trip or for occasional travel.

The 360-dpi Canon Bubble Jet Printer BJ-20 deserves an honorable mention. The printer gets a nod for including as standard equipment a detachable 50-page cut-sheet feeder, which seems to have solved the jamming problems we had with the Canon BJ-10ex's optional cut-sheet feeder (see the August issue). Like the Kodak 701, the Canon offering provides high-quality text output. Unlike the Kodak, the BJ-20 also accepts envelopes. But drawbacks—a lack of resident landscape fonts and the fact that it makes only a few of its fonts available in its native emulation (even using the recommended Windows driver or the control panel)—make the Canon BJ-20 a runner-up to the Kodak 701.

Canon Computer Systems Inc.) make less of an impression, but offer their own assets.

The Canon Bubble Jet Printer BJ-20 ($599) boasts several features not offered in the Canon Bubble Jet Printer BJ-10e or BJ-10ex, including a standard sheet feeder. The Canon Bubble Jet Printer BJC-800 ($2,795) falls short of the HP PaintJet XL300 in high-quality color output, but it offers large-media printing at a bargain price. Both print at a resolution of 360 dots per inch using Canon's 64-nozzle printheads.

CANON BUBBLE JET PRINTER BJ-20

The BJ-20 builds on the design of what was once the preeminent portable printer—the BJ-10e. Measuring 2 by 12.3 by 8.5 inches (HWD)in its travel configuration, the BJ-20 compares in size to a notebook PC. Though it is small enough for travel, the BJ-20 looks mammoth next to the tiny Citizen PN48 thermal fusion printer (see our August review of portable printers for details).

Canon Bubble Jet Printer BJ-20, Canon Bubble Jet Printer BJC-800

As a small-footprint desktop printer, the BJ-20 has some drawbacks and some advantages. On the plus side, a 50-page sheet feeder is standard equipment; a 30-page sheet feeder is a $90 option on the $499 BJ-10ex. Unlike the BJ-10ex, the BJ-20 automatically senses when the sheet feeder is attached. The sheet feeder worked well in testing; a separate manual feed accepts envelopes and heavy stock.

Further enhancing the product, Canon has added Orator and Orator-S fonts to the Epson emulation, included font indicator lights and emulation selection on the control panel, and added a draft mode rated at 110 cps.

Among the best qualities of this printer—which should sell at street prices as low as $400—are its 360-dpi resolution and fine-looking text. Also, the printer is the only ink jet here to provide both Epson and IBM emulations as standard features.

With its $50, 0.6-pound internal battery pack, the BJ-20 prints as many as 40 pages on a single 4-hour charge. Including its optional battery pack and 1.4-pound AC adapter, the printer adds 6.3 pounds to your travel weight.

As a desktop printer, the BJ-20 measures 13 by 15.6 by 12.3 inches (HWD) with its sheet feeder. Unfortunately, the BJ-20 is somewhat limited as a desktop printer. To access each of its internal typefaces, for example, you must switch the printer to its Epson emulation; the printer allows use of only the Courier and draft fonts in its native Canon/IBM mode. You'll find no internal landscape fonts.

The BJ-20 was slower than its monochrome desktop competition, clocking in at 39 cps in quality mode and 45 cps in draft mode. Even with its drawbacks, the BJ-20 offers enough positive features that it can still prove a good choice if you need a dual-duty printer.

CANON BUBBLE JET PRINTER BJC-800

The BJC-800 ($2,795) does a fine job of printing on coated media—as wide as 11.7 inches from its flip-down 100-sheet paper tray—without requiring extra memory. No other printer in this price range can make this claim.

Canon touts the BJC-800 as a plain-paper printer, but black and color graphics alike appear faded on plain paper. While it lacks the plain-paper output quality and low cost that characterize the HP DeskJet models, it can apply both black and color ink to each page of coated paper with aplomb. That's a claim neither of the DeskJets can make.

No matter what the media, though, the Canon can't match the output quality or the lower cost per page of the more expensive HP PaintJet XL300. It also lacks the Adobe PostScript option, the Pantone certification, and the network interface of the PaintJet XL300.

Then again, the BJC-800 will print whatever you throw at it, given enough time and system resources. Essentially a page printer, the HP PaintJet XL300 requires lots of additional RAM to print pages full of complex graphics.

The BJC-800 turned in mixed results during our speed tests. It sprinted through Text Speed trials at 65 cps in quality mode, leaving the PaintJet

Photographs by Thom O'Connor

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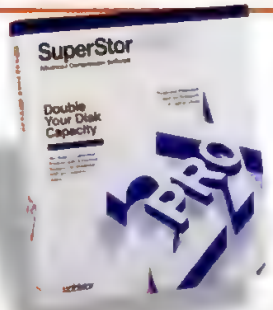

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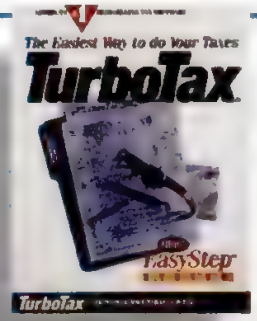

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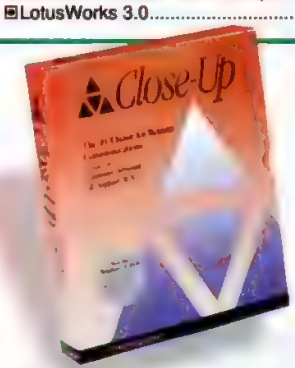

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8137 ☐ *Office 3.0 for Windows*—Get four powerful Windows applications at one great price. Includes Word 2.0, Excel 4.0, PowerPoint 3.0, & MS Mail Workstation 3.0 (requires a network running MS Mail) **$479.**

Teleware
9847 ⊞M.Y.O.B. 3.0 for Windows ..... 139.
Time Solutions
7295 ⊞Med$ure 1.0 ..... 69.
TIMESLIPS
5698 ⊞Timeslips Release 5 ..... 189.
T/Maker
6027 ☐Fax Mania DOS or 7911 Windows *ea.* 27.
Tool Technology
3863 WinTools 1.0 for Windows *(3½" only)*.. 119.
Touchstone Software
7420 ⊞Check It Plus 3.0 ..... 85.
Traveling Software
4407 ⊞LapLink Pro 4.0 ..... 99.
WordPerfect Corporation
3804 ⊞WordPerfect 269. 3494 ⊞for Windows 279.
XTree
8328 ☐XTree 1.0 for Windows ..... 65.
6161 ⊞XTree Gold 2.5 ..... 95.

RECREATIONAL/EDUCATIONAL

Abracadata
3629 ⊞Design Your Own Home-Architecture 3.6 32.
Buena Vista Software
8351 ☐Heaven and Earth 1.0 ..... 29.
Broderbund ... CP
3340 ⊞Kid Pix 1.0 ..... 35.
5851 ⊞SimCity 1.0 from Maxis ..... 29.
4411 ⊞SimEarth 1.0 for Windows from Maxis 45.
Davidson & Associates
3947 ⊞Math Blaster Plus ..... 29.
4183 ⊞KidWorks ..... 29.

Hayes ... 2 years
8187 *OPTIMA 24+ FAX 96*—Combines a 2400 bps V.42bis data modem and a 9600 bps fax along with genuine Hayes quality, performance, & compatibility at a great price. Incl. *Smartcom EZ & Smartcom Fax software* **$159.**

Electronic Arts
7525 ⊞PGA 1.0 for Windows ..... $39.
1811 ☐Patriot 1.0 ..... 49.
HyperGlot Software
(French, German, Italian, Spanish available.)
☐Word Torture for Windows ..... *ea.* 34.
☐Word Torture 3.0 ..... *ea.* 29.
Interplay
8653 ⊞Mario Teaches Typing ..... 24.
4692 ⊞Dvorak on Typing for Windows ..... 29.
4684 ⊞Dvorak Top 30 *(30 best shareware)* .... 35.
Knowledge Adventure
6456 ☐Isaac Asimov's Science Adventure ..... 49.
8163 ☐Knowledge Adventure 1.0 *(VGA ver.)*. 49.
Microsoft
2858 ☐Flight Simulator 4.0 ..... 39.
Penton Overseas
⊞VocabuLearn/ce Levels I & II *(French, Italian, German, Spanish, Russian, Hebrew and Japanese)* ..... *ea.* 35.
Personal Training Systems
Training tutorials-beg. to adv. for Windows, Excel, PageMaker WordPerfect, Ami Pro, Microsoft Word & Lotus 1-2-3 *(3½")* *ea.* 65.
Sierra On-Line ... CP
8591 ☐Quest for Glory III ..... 39.
5150 ☐Aces of the Pacific ..... 45.
3193 ☐Police Quest 3 ..... 45.

Diamond Computer ... 5 years
8333 *SpeedStar 24X Graphics Accelerator*—Fastest VGA accelerator on the market today according to *PC Magazine*'s WinMark scores. 24-bit color support in Windows. $500 free software bundle. Made in the USA... **$179.**

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5147 ⊞Orbits 1.0 ..... 39.
5145 ⊞Bodyworks 1.0 or 8531 ⊞Autoworks *ea.* 49.
Software Toolworks
4534 ⊞Mavis Beacon Teaches Typing 2.0 *(CP)* 29.
3023 ⊞ChessMaster 3000 29. 3032 Windows 35.
5032 Miracle Piano Teacher *(incl. kybd.)*..... 325.
Spectrum Holobyte
4833 ⊞Super Tetris 1.0 for Windows ..... 29.
8323 ⊞Tetris Classic ..... 29.
Toyogo
5138 ⊞Go Master Deluxe 5.0 for Windows..... 99.
5143 ⊞Go Master Deluxe 5.0 ..... 99.
Walt Disney Computer Software
4416 Sound Source ..... 27.
1162 ⊞Mickey & Friends Fun Pack 1.0 ..... 23.
2629 ⊞Mickey's 123's or 2624 ABC's ..... *ea.* 29.
9984 ⊞The Animation Studio 1.0 ..... 79.

HARDWARE

Warranties listed next to manufacturer.

3 Com ... lifetime (conditional)
3453 EtherLink II/16... 159. 3469 II/16 TP.. 169.
American Power ... 2 years
7108 Smart UPS 400 339. 7105 UPS 600 439.
3819 Back-UPS 250. 115. 3858 UPS 400 . 179.
7107 Back-UPS 450. 215. 3823 UPS 600 . 295.

Software Marketing
8531 ⊞ *Autoworks*—Get to know your car bumper to bumper. Provides overview of systems, in-depth graphics, & animation **$49.**
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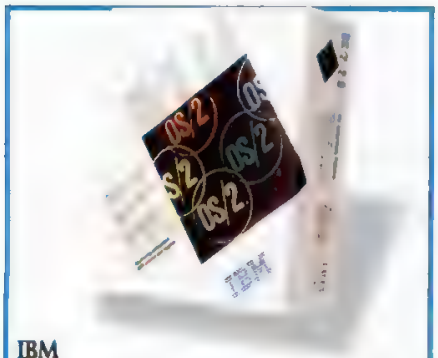
9985 VGA Integra *(1024 x 768, 16 colors)*..... 84.
8463 VGA Wonder XL24 *(with 1 MB)*..... 149.
2382 Graphics Vantage VGA *(with 1 MB)*..... 225.
9822 8514/Ultra *(with 1 MB) (requires VGA)*. 269.
2012 Graphics Ultra with VGA *(with 1 MB)*... 299.
3902 Stereo•F/X *(sound board)* ..... 109.
3900 VGA Stereo•F/X *(w/512K, upgrd. to 1 MB)* 215.
Boca Research ... 5 years
7150 BOCARAM/AT PLUS *(2 MB)* ..... 175.
7139 *(4 MB)* ..... 259. 7138 *(8 MB)*..... 459.
8398 External 14,400 Baud V.32 FaxModem 275.
8397 Internal 14,400 Baud V.32 FaxModem 219.
6998 I/O Board for AT.. 49. 6999 for PS/2.. 89.
8380 BasicVGA.... 49. 8381 SuperVGA... 115.
Bravo Communications ... 2 years
7400 2 Position Laser Compatible Switch Box 109.
7501 CPS1021 *(electronic switch box)*..... 135.
Brown-Wagh ... 1 year
8578 Creative Labs Sound Blaster ..... 109.
2336 Creative Labs Sound Blaster Pro ..... 189.
Caere ... 1 year
8158 Typist Plus Graphics ..... 375.
Canon ... 1 year
We are an authorized Canon Service Center.
7894 BJ-10ex Printer *(4.6 lb.)* ..... 299.
8940 BJ-C800 Color BubbleJet Printer ..... 1899.
7897 BubbleJet Ink Cartridge *(BJ-10ex)* ..... 23.
7896 BJ-10ex Sheet Feeder ..... 75.
Cardinal ... 1 year
8689 386SX-33 MHz Motherboard ØK ..... 275.
8690 MVP24I Modem Value Pack ..... 39.
8691 MVPI24IF FaxModem Value Pack ..... 64.
8633 VideoColor 24 VGA7000 ..... 179.
Chips & Technologies ... lifetime
6137 SuperMath 387DX-25 ..... 81.
6138 387DX-33.... 85. 6126 387SX-25 .... 69.
CoStar ... 1 year
1947 LabelWriter II ..... 185.
COVOX ... 1 year
5543 Sound Master II ..... 145.
Curtis ... lifetime
1708 Ruby-Plus SPF-2+ ..... 59.
7358 Command Center SPF-4 ..... 79.
Cyrix Corporation ... 5 years
MATH COPROCESSORS
9877 FasMath 83S87-16 *(SX compatible)* ..... 69.
9875 FasMath 83D87-25 or 9876 83D87-33 *ea.* 89.
Diamond Computer ... 5 years
8333 SpeedStar 24X Graphics Accelerator .. 179.
6945 Stealth Hi-Color ..... 239.
Epson ... 2 years
We are an authorized Epson Serivce Center
5555 AP-3250 *(80 col., 200 cps, 24 pin)* ..... 229.
1906 FX-850 *(80 col., 264 cps, 9 pin)* ..... 319.
1904 FX-1050 *(136 col., 264 cps, 9 pin)* ..... 449.

Thanksgiving Deals.



IBM
7303 ☐ *OS/2 2.0 Upgrade from DOS*—Upgrade to OS/2 2.0 from DOS (any version). Full fledged operating system that runs DOS, Windows, and OS/2 applications. 386SX PC's and above ..... **$99.**

2358	LQ-570 *(80 col., 252 cps)*	289.
2361	LQ-870 *(80 col., 330 cps)*	489.
2357	LQ-1170 *(136 col., 330 cps)*	669.
5184	LX-810 *(80 col., 180 cps, 9 pin)*	185.
	Hauppauge Computer ... 1 year	
3670	33 MHz 486 Motherboard for AT *(1 MB)*	1229.
4008	Win/TV	439.
	Hayes ... 2 years	
7391	ULTRA 96 Modem	599.
5024	ULTRA 144 Modem	669.
1345	OPTIMA 24 Modem	149.
3522	OPTIMA 96 Modem	379.
8187	OPTIMA 24+ FAX 96	159.
7395	OPTIMA 144+ FAX 144	479.
9884	Pocket Edition 2400	119.
	Hewlett-Packard ... 1 year	
3175	DeskJet 500C *(color) (with toner)*	749.
3957	LaserJet IIP Plus *(with toner)*	879.
9993	LaserJet IIIP *(with toner)*	1099.
6754	LaserJet III *(with toner)*	1599.
	Intel ... 3 years	
3864	14.4EX Modem	469.
1086	Matched Memory Classic Memory Brd. 0k	115.
5990	SatisFAXtion Modem 100	99.
5992	SatisFAXtion Modem 200	299.
5994	Model 400. 399. 5995 Model 400E .	449.
5999	⊞FAXability Plus *(software)*	79.
6003	⊞FAXability Plus OCR *(software)*	165.
2994	EtherExpress 16 or 3021 16 TP .... *ea.*	129.
6418	OverDrive Processor *(for 486SX-25 MHz)*	579.
8943	OverDrive Processor *(for 80486DX-33)*	759.
	MATH COPROCESSORS	
4750	80387SX *(all 80386SX CPU's)*	79.
5409	80387DX *(all 80387DX CPU's)*	85.
	Kensington Microware ... 1 year	
	Full line available. Partial listing.	
4973	PowerTree 20 *(6 outlets, EMI/RFI Filtering)*	24.
2582	Master Piece Plus 95. 2587 Remote	105.
7899	Expert Mouse *serial*... 99. 7900 *bus*...	115.
3311	MasterStand	59.
	Keytronic ... 3 years	
4518	101 Plus Keyboard	99.
	Logitech ... limited lifetime	
3996	Trackman2 *(combo)*	84.
2343	Trackman Portable	99.
7975	ScanMan 256	269.
3295	MouseMan *(combo)* 69. 9766 *(cordless)*	89.
	MediaVision ... 3 years	
5637	ProAudio Spectrum 16	199.
8404	Thunder & Lightning	219.
5638	MultiMedia PC Upgrade Kit 16	969.

	Megahertz ... 5 years	
6576	P296FMV Fax Modem *(9600 baud V.42)*	$479.
6574	T396FM Fax Modem *(9600 baud)*	499.
	Microsoft ... lifetime	
7597	Microsoft Mouse *(bus or serial)*	85.
2898	Mouse with Windows 3.0 *(bus or serial)*	149.
1896	Ballpoint Mouse *(serial only)*	119.
	MicroSpeed ... 1 year	
6007	PC-TRAC Trackball *serial*	75.
	Microtek ... 1 year	
2736	ScanMaker 600G *(gray-scale scanner)*	759.
2739	ScanMaker 600Z *(color scanner)*	1249.
	Mouse Systems ... lifetime	
3213	PC Trackball II *(serial)*	55.
7878	PC Mouse III *(serial)*	69.
5979	NewPoint	79.
	Mustek ... 1 year	
8454	Matador 105 for DOS	95.
8450	Color Artist for Windows	319.
	NEC ... 2 years	
4252	MultiSync 3FGX Monitor *(14")*	689.
4249	4FG Monitor *(15")* 799. 3151 5FG *(17")*	1449.
5377	SilentWriter Model 95 PostScript Laser	1439.

Hewlett-Packard ... 1 year
9993 *LaserJet IIIP (with toner)*—Superior speed and built-in typefaces with PCL 5 language makes this laser printer a stand out ..... **$1099.**

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	We are an autorized Okidata Service Center.	
5093	OL400 Page Printer *(4 ppm)*	649.
9590	OL810 Page Printer	1089.
5094	OL830 Page Printer *(8 ppm)*	1299.
3025	Toner Cartridge	25.
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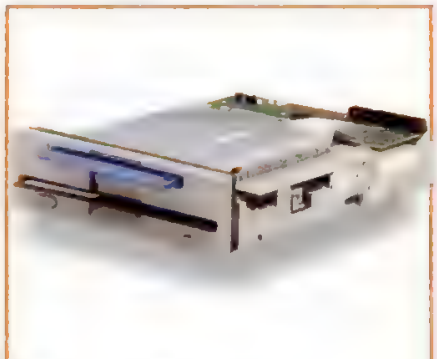
7863	ProDesigner VGA IIS *(with 1 MB, includes RAMDAC chip)*	189.
4071	Fahrenheit 1280i with 1 MB	299.
	Pacific Data ... lifetime/60 day MBG	
	Memory upgrade for LJ IIP, III, IIID, IIIP:	
7055	*2 MB* ..... 119. 7759 *4 MB*	199.
	Memory upgrade for LaserJet II/IID:	
6838	*2 MB* ..... 145. 6836 *4 MB*	259.
7158	Pacific Page PE *(LJ IID, IIP, III, IIID, IIIP)*	299.
9833	Pacific Page XL *(w/accelerator board)*	699.
5729	ProTracer *(personal CAD printer) (1 yr.)*	1099.

800-800-0004

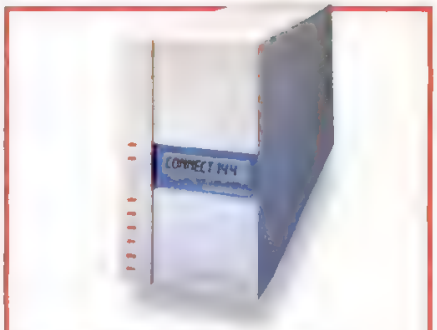
MMC

PC Connection 0004
6 Mill Street
Marlow, NH 03456
SALES 603-446-0004 **FAX** 603-446-7791



TEAC ... 1 year
4414 *3½"/5¼" Dual Floppy Drive*—Get two drives in one. TEAC's new Dual Floppy Disk Drive gives you both 3½" and 5¼" in one, saving you space and money ... **$145.**

	PC Power & Cooling ... 2 years	
3203	Turbo Cool 200	149.
7915	Turbo Cool 300	159.
	Practical Peripherals ... lifetime	
3102	PM2400 Modem *(external)*	99.
8993	PM2400 Modem *(internal, V.42bis)*	115.
8994	PM2400 Modem *(external, V.42bis)*	125.
8132	PM2400 Pocket Modem	109.
2266	PM9600 Internal Modem	275.
7934	PM9600SA Modem	289.
2264	PM2400FX96 *(internal modem/fax)*	95.
1344	PM2400FX96SA *(external modem/fax)*	99.
3803	PM14400FX96 *(internal modem/fax)*	359.
2425	PM14400FXSA *(external modem/fax)*	399.
	Prometheus ... 2 years	
6444	ProModem Ultima Home Office *(int.)*	389.
	PSION ... 1 year	
6449	Series 3 Palmtop *(256K)*	379.
	Solectek ... 1 year	
4804	Pocket Fax Windows	189.
4769	Pocket LAN Ethernet	239.
	Standard Microsystems ... 5 years	
6376	Ethercard Plus Elite 16 or 6370 16T *ea.*	139.
6372	Ethercard Plus Elite 16 *(6 Pack)*	759.
	Targus ... lifetime	
1305	Universal Notebook *(computer case)*	69.



Practical Peripherals ... lifetime
2425 *PM14400FXSA Modem/Fax*—Get ultra high speed 14,400 bps data transmission as well as Group III S/R fax capabilities in one integrated and affordable package. Includes *QuickLink II* for modem and fax communications **$399.**

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No turkeys, here!

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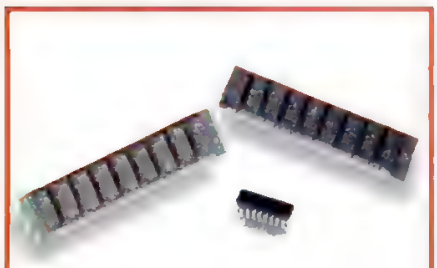
6315 Fax Line Manager 203 ..... $139.
TheComplete PC ... 2 years
8609 TheComplete Modem 65. 6069 Plus.... 95.
8599 TheComplete Turbo Modem Plus *(Ext.)* 289.
8593 TheComplete Communicator Gold..... 479.
5140 TheComplete Page Scanner w/OCR ... 579.
Tripp Lite ... 2 years
6199 Isobar 4-6 *(4 outlets, Gold Seal Warranty)* 49.
6200 Isobar 6-6 *(6 outlets, Gold Seal Warranty)* 59.
8630 Isobar Ultra 6 *(diagnostic circuitry)* ..... 52.
9312 BC500 Power Backup ..... 219.
6506 BC1250 LAN Power Backup ..... 499.
6018 LC1200 *(line conditioner)* ..... 159.
1528 PS6.0 *(600VA online UPS)* ..... 559.
Video 7 ... 7 years
7362 WinVGA *(includes 1 MB)*..... 165.
9768 VRAM II VGA 1 MB ..... 329.
Zoom Telephonics ... 7 years
1307 Int. 2400 Baud w/9600 Baud Fax Modem 79.
1178 Ext. 2400 Baud w/9600 Baud Fax Modem 92.
1494 Ext. 9600V.32bis... 195. 3075 Int. ... 195.
3574 Ext. 2400 Baud V.42/9600 Baud Fax... 115.
3386 FaxModem AFC *(2400 baud 96S/48R)*.. 59.
4430 FaxModem AFX *(2400 baud 96S/48R)*.. 79.
4429 FaxModem V.32bis 14,400 baud *(int.)*. 219.
4428 FaxModem V.32bis 14,400 baud *(ext.)* 259.
7921 Pocket FaxModem ..... 87.



PC Connection ... 1 year
Bring out the power of Windows or any number of applications by boosting your memory.
5510 *1 MB x 9 SIMMs (80 ns)*..... **$45.**
2497 *4 MB x 9 SIMMs (80 ns)*..... **139.**
5746 *1 MB Chips (80 ns, set of 9)* ..... **45.**

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Colorado Memory Systems ... 1 year
4194 Jumbo 120 Tape Backup ..... 199.
4354 Jumbo 250 Tape Backup ..... 269.
Conner Peripherals ... 1 year
2339 CP30104H 120 MB IDE HD *(19 ms)*.... 399.
1337 CP3204 200 MB IDE HD *(16 ms)*..... 539.
IOMEGA ... 1 year
We are an authorized Iomega Service Center.
6499 Transportable 90 PRO ..... 679.
6502 Insider 90 PRO 579. 6501 Dual 90 PRO 1479.
6343 PC Powered 90 *(incl. PC2B & cart.)*..... 499.
6344 PC Powered 90 PRO *(incl. PC2B, cartridge & Central Point Software)*..... 599.
2500 PC2B-2 Controller ..... 149.
2530 90 MB Cartridge.. 149. 2467 Tripak .. 439.
8480 Tape250 Insider Tape Backup ..... 239.
8481 Tape250 Inside Half-Height Tape Bckp 259.
8482 Tape250 PC Powered Tape Backup.... 359.
Mountain Network Solutions ... 2 years
3812 FS8500 IDE Tape Backup *(304 M)*..... 499.
6153 DC2120 Tape Cartridge *(5 pack)*..... 149.
NEC ... 2 years
6577 CDR37 Portable CD-ROM Drive ..... 399.
6582 CDR74 Portable CD-ROM Drive ..... 589.
6581 CDR84 for PC/XT/AT ..... 499.
7023 MPC Upgrade Kit *(with CDR37)*..... 949.
7021 MPC Upgrade Kit *(with CDR84)*..... 1079.

Pacific Rim ... 1 year
1304 1.2 MB External *(for any parallel port)* $239.
2761 1.44EX MB Ext. *(for any parallel port)*.. 239.
Quantum ... 2 years
8304 Plus Hardcard II XL 50 MB *(9 ms)*..... 225.
8287 Plus Hardcard II XL 105 MB *(9 ms)*..... 389.
Summit Memory Systems ... 2 years
6436 SE120 Tape Backup ..... 215.
TEAC ... 1 year
6951 1.2 MB Drive for AT ..... 65.
4670 1.44 MB Drive for PC/XT *(3½")* ..... 59.
4326 1.44 MB Drive for AT *(3½", w/Bastech)* 75.
4414 3½"/5¼" Dual Floppy Drive ..... 145.

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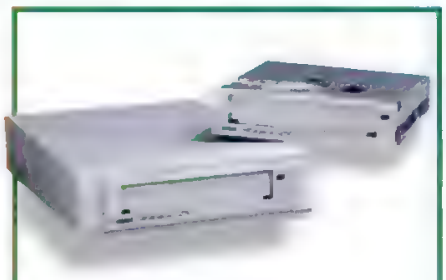
6556 256k DRAMs *(100 ns, set of 9)* ..... 19.
5510 1 MB x 9 SIMMs *(80 nanosecond)*..... 45.
2497 4 MB x 9 SIMMs *(80 nanosecond)*..... 139.
5746 1 MB Chips *(80 ns, set of 9)*..... 45.

IOMEGA ... 1 year
6343 *PC Powered 90*—Lowest priced Bernoulli drive ever in one complete, convenient package. Includes 90 MB cartridge, PC2B interface card, and cable..... **$499.**
6344 *PC Powered 90 PRO* ..... **599.**



IOMEGA ... 1 year
Tape250—QIC & Irwin compatibility in one affordable tape drive! Stores 250M & includes data compression & *Central Point Backup*.
8480 *Tape250 Insider Tape Backup*..... **$239.**
8481 *Insider HH* **259.** 8482 *PC Powered* **359.**

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Fuji ... lifetime
2214 3½" DS Disks*(10)*.... 9. 2242 *(50)*..... 32.
2215 3½" HD Disks*(10)*.. 15. 2241 *(50)*..... 59.
2239 3½" HD Color Disks *(Qty. 10)*..... 16.
2243 3½" DS Color Disks *(Qty. 10)*..... 10.
Sony ... lifetime
3292 5¼" HD Disks*(Qty. 10)* ..... 11.
3297 3½" DS Disks *(10)*..... 9. 6148 *(30)*.. 25.
3298 3½" HD Disks *(10)*... 15. 6375 *(30)*.. 42.
8185 QD2040..... 14. 1895 QD2120..... 21.

3M ... lifetime
3943 DC2000..... $17. 1581 DC2120..... $22.
Toshiba ... 2 years
4858 3½" 2.88 MB ED Disks *(Qty. 5)*..... 28.
9755 3½" 2.88 MB ED Disks *(Qty. 10)*..... 53.

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3M ... lifetime
1581 *DC2120 Data Cartridge*—¼" QIC 40 and QIC 80 compatible data cartridge. Unformatted..... **$22.**

SHIPPING

Continental U.S.: The total freight charge on any order placed with PC Connection is only $5. Barring events beyond our control, all credit card orders phoned in weekdays by 3:00 a.m. Eastern Time will ship Airborne Express for delivery the next business day. Which means *same day* delivery for orders placed between midnight and 3:00 a.m. Eastern Time. (Some orders may ship by UPS Ground for next day delivery). Saturday delivery available to many areas upon request at no additional charge. Order all day Saturday through noon on Sunday for Monday delivery. (Some areas require an additional day delivery).
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All other areas: Please call 603-446-0004 or FAX 603-446-7791 for information.

The frost is all over the proverbial pumpkin up here in Marlow, NH (pop. 601), and we're ready to hunker down for some serious snowfalls and toe-tingling temperatures. Meanwhile, our mascots have paused to give thanks for another year of successful nocturnal visits to our vegetable garden! Well, why not share the bounty? That's what we're doing with this smorgasbord of specials good through 11/30/92. No turkeys here!

Asymetrix
1766 ☒ *MediaBlitz! 1.0*—Windows 3.1 multimedia utility for editing and synchronizing clips. Create shows in minutes and integrate them into other Windows applications with DDE. Over 70 clips free upon registration.

$69

T E R M S

- Everything Overnight® $5.
- Weekend Shipping, too!
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- One-Minute Mail Order™

See complete terms on opposite page.

Adobe Systems
5988 ☐ *Adobe Illustrator 4.0 Competitive Upgrade*—Owners of draw and design programs can trade up to Illustrator 4.0. Includes *TypeAlign, ATM, Separator*, 40 fonts, pre-drawn artwork, and more.

$189

Lotus
5799 ☒ *Ami Pro 3.0*—Includes new direct access features, including Fast Format, SmartIcon sets, Drag & Drop, and SmartClick. Get a free copy of *Intermission Screen Saver* (ends 11/30/92).

$249

Intel ... 3 years
5990 *SatisFAXtion Modem 100*—Intel SatisFAXtion interface and compatibility at an unbeatable price. Internal 2400 bps data modem, 9600/4800 bps fax, bundled with a free copy of *Faxability Plus* (ends 11/30/92).

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5104 ☒ *Alpha Four 2.0 Server w/2 Free LAN Packs*—Fully relational database-management system for non-programmers. Create complex applications through menus. Uses dBase file format. Incl. *Presentation Express* and a *Zip Code Database* free (ends 11/30/92).

$329

9724 ☐ *Alpha Four 2.0 Competitive Upgrd. (single/standalone version)* $99.

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Performance Tests: Ink Jet Printers

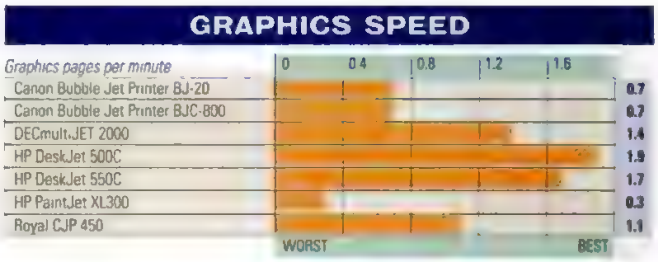
Two color printers from Hewlett-Packard—the HP DeskJet 500C and the HP DeskJet 550C—proved the fastest of the group. The HP PaintJet XL300 produces excellent color output but lagged behind in speed.

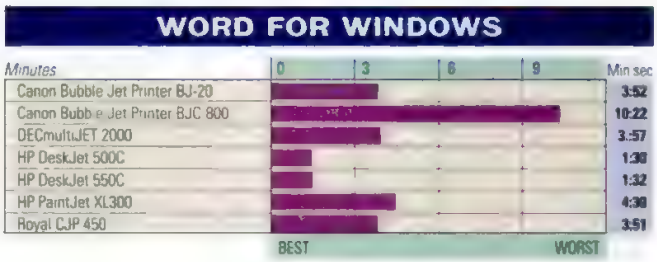
The **Text Speed** test measures the printer's speed in sending and printing one copy of a two-page business letter with 1-inch margins in 10-cpi type. We ran the test twice, once in draft mode and once in quality mode.

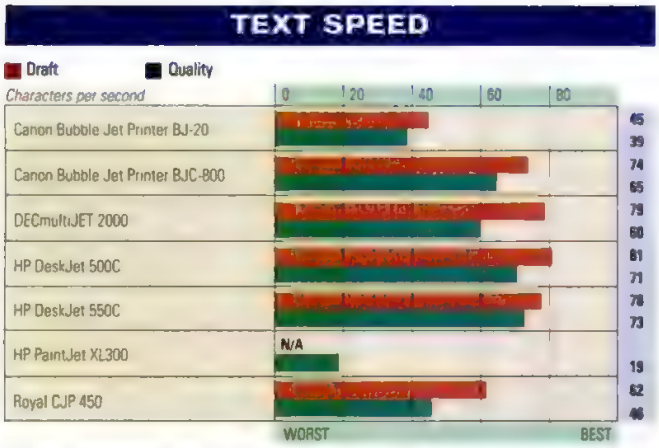
The **Graphics Speed** test measures the printer's speed in sending and printing two copies of a graphics image created using CorelDRAW and Microsoft Windows, Version 3.1.

The **Word for Windows** test records the time required to print a two-page business report that uses multiple fonts and type styles. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

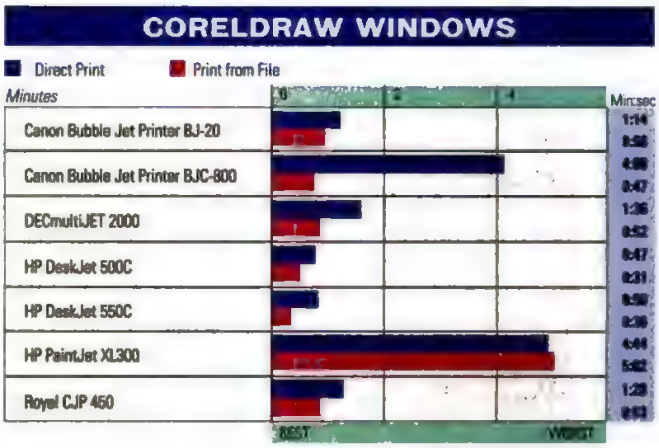
The **CorelDRAW** test measures the time required to print a CorelDRAW graphics file. We run the test in two different ways: first as a direct print from within the application (Direct Print) and then as a print of a pregenerated file external to the application (Print from File). It uses the same graphics file as the Graphics Speed test does. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.







N/A—Not applicable: This printer does not operate in draft mode.



XL300 far behind. The Canon also easily bested the PaintJet on our Graphics Speed tests.

The Microsoft Windows 3.1 driver Canon provides with the unit—which sometimes accessed the hard disk for 2 minutes or more—consistently required longer to process graphics after a reboot than on subsequent trials. While the BJC-800's print time on the Print from File version of the CorelDRAW test was far ahead of the PaintJet XL300's time, its time on the Direct Print version of the CorelDRAW test was only somewhat faster than the PaintJet XL300's time, and its performance on our Word for Windows performance test was the worst of all the ink jets we tested.

Unlike the other products, the BJC-800 has nondisposable printheads separate from its cartridges. Canon rates the printheads for a long life of 100 million characters, but the built-in head-cleaning routines result in printing delays because the printer must pause to pump more ink into its wells.

The BJC-800's control panel is remarkably convenient, complete with a 16-character LCD. The BJC-800 comes with three resident typefaces but doesn't support landscape fonts. It also lacks support for cartridge fonts and additional memory for downloadable fonts. The printer comes with only a parallel interface (the $2,995 BJC-820 offers a SCSI interface for Macintosh installations) and

Make it clear.

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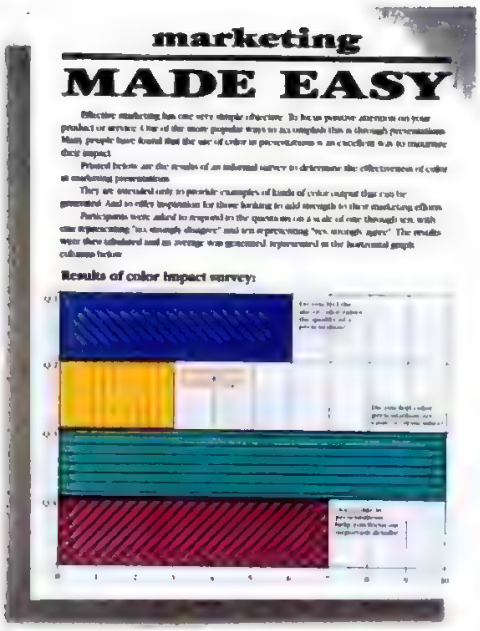

The new HP DeskJet 550C. $1,099.

Great things happen when you have a DeskJet 550C printer from Hewlett-Packard. Because it's never been so easy to print high-quality black and white. And brilliant color.

The DeskJet 550C prints true black at 300 dots per inch. Clean, crisp and sharp, for the kind of professional print quality you expect from HP.

For added impact, the DeskJet 550C makes it easy to add color to your work. The black and color cartridges are built in and work together. Giving you access to millions of stunning colors.

You can get an HP DeskJet 550C, or a DeskWriter 550C for the Macintosh, for a suggested list price of just $1,099.* So if you're looking for an affordable way to make a powerful impression, get a DeskJet 550C printer. Then see what happens.

For another cost-effective way to get great-looking black and white and color, the HP DeskJet 500C and the DeskWriter C are now available for a low price of just $779.*

Call 1-800-552-8500, Ext. 7109 for the name of the authorized HP dealer nearest you† To receive information by fax call 1-800-333-1917, choose HP FIRST, document #9605.

DeskJet Printers Make it happen.

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*Suggested U.S. list price. †In Canada call 1-800-387-3867, Ext. 7109.

Canon Bubble Jet Printer BJ-20 — $599

64-nozzle monochrome ink jet printer capable of letter-size printing

Draft Text Speed: 45 cps
Quality Text Speed: 39 cps
Graphics Speed: 0.7 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 52 sec.
CorelDRAW (Direct): 1 min. 14 sec.
CorelDRAW (File): 0 min. 58 sec.

Script
Roman
Sans Serif
Courier

Canon Bubble Jet Printer BJC-800 — $2,795

64-nozzle color ink jet printer capable of 11- by 17-inch printing

Draft Text Speed: 74 cps
Quality Text Speed: 65 cps
Graphics Speed: 0.7 gppm

WINDOWS APPLICATIONS:
Word for Windows: 10 min. 22 sec.
CorelDRAW (Direct): 4 min. 8 sec.
CorelDRAW (File): 0 min. 47 sec.

Roman
Sans Serif
Courier

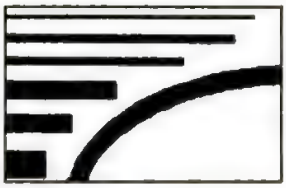
DECmultiJET 2000 — $539

50-nozzle monochrome ink jet printer capable of letter-size printing

Draft Text Speed: 79 cps
Quality Text Speed: 60 cps
Graphics Speed: 1.4 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 57 sec.
CorelDRAW (Direct): 1 min. 36 sec.
CorelDRAW (File): 0 min. 52 sec.

Courier
Letter Gothic
Times Nordic



HP DeskJet 500C — $779

50-nozzle (black), 48-nozzle (color) ink jet printer capable of letter-size printing

Draft Text Speed: 81 cps
Quality Text Speed: 71 cps
Graphics Speed: 1.9 gppm

WINDOWS APPLICATIONS:
Word for Windows: 1 min. 30 sec.
CorelDRAW (Direct): 0 min. 47 sec.
CorelDRAW (File): 0 min. 31 sec.

Courier
Universe
CG Times
Letter Gothic

HP DeskJet 550C — $1,099

PC MAGAZINE EDITORS' CHOICE

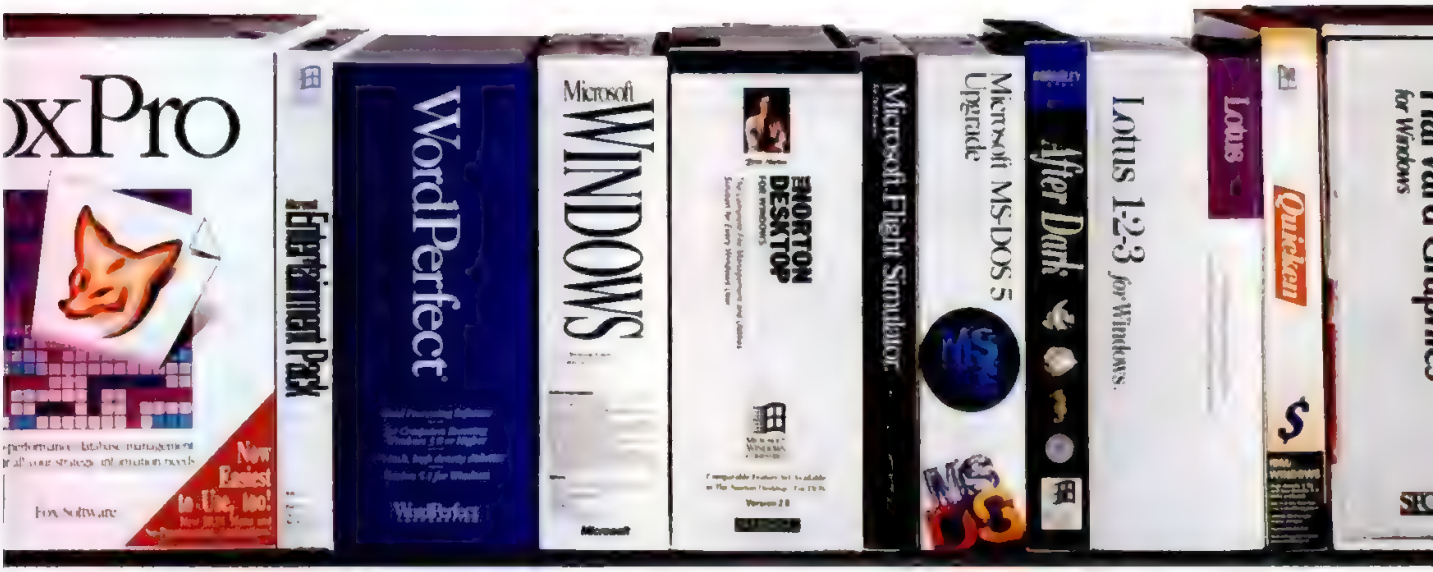
50-nozzle (black), 48-nozzle (color) ink jet printer capable of letter-size printing

Draft Text Speed: 78 cps
Quality Text Speed: 73 cps
Graphics Speed: 1.7 gppm

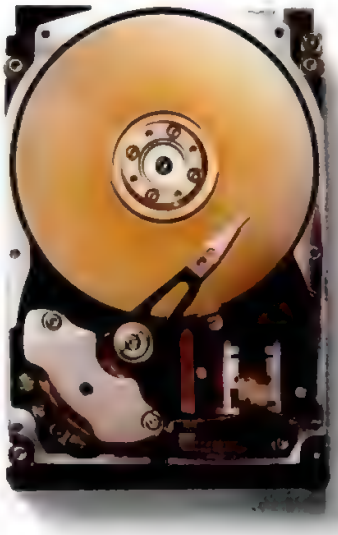
WINDOWS APPLICATIONS:
Word for Windows: 1 min. 32 sec.
CorelDRAW (Direct): 0 min. 50 sec.
CorelDRAW (File): 0 min. 36 sec.

Courier
CG Times
Universe
Letter Gothic

Once you have all these boxes,



you need this box to store them in.



SEAGATE'S 106 MB ST3120

Have you noticed how today's top-selling software programs are taking up more and more of your precious hard disc capacity? Why, just the applications shown above can eat up over 60 megabytes of valuable storage space before you've even created your first document.

With space-hungry programs like these, even 80 megabyte drives can limit your storage capabilities. But Seagate's ST3120 is just the ticket. It packs 106 MB into a 3.5" low-profile package, with a 15 msec access time and an AT interface. And it does so at a superior cost-per-megabyte rate compared to other drives. So you not only get all the storage and performance you'll need, but you get a great value, too.

So don't let the size of your hard drive restrict your software collection. Check out the ST3120 at your Authorized Seagate Distributor. For complete product information, call Seagate at 408-438-6550.

Seagate

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HP PaintJet XL300 — $3,495

EDITORS' CHOICE

50-nozzle color ink jet printer capable of 11- by 17-inch printing

Draft Text Speed: N/A
Quality Text Speed: 19 cps
Graphics Speed: 0.3 gppm

WINDOWS APPLICATIONS:
Word for Windows: 4 min. 30 sec
CorelDRAW (Direct): 4 min. 55 sec.
CorelDRAW (File): 5 min. 2 sec.

Courier
LinePrinter
CG Times
Universe

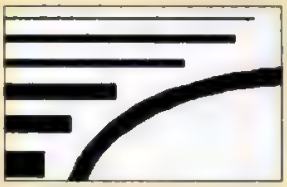
Royal CJP 450 — $499.95

50-nozzle monochrome ink jet printer capable of letter-size printing

Draft Text Speed: 62 cps
Quality Text Speed: 46 cps
Graphics Speed: 1.1 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 51 sec.
CorelDRAW (Direct): 1 min. 17 sec.
CorelDRAW (File): 0 min. 53 sec.

Times Nordic
Letter Gothic
Courier



emulates only the Epson LQ 2550.

In terms of features, the BJC-800 doesn't have what it takes to go head-to-head with the PaintJet XL300. Then again, this four-color printer is fine for printing high-resolution text and graphics on coated media, without requiring extra memory.

Canon Computer Systems Inc., *123 E. Paularino Ave., Costa Mesa, CA 92628; 800-848-4123; fax, 714-438-3389.*

Canon Bubble Jet Printer BJ-20 *List price: $599. Nickel cadmium battery, $50; additional 120V/60Hz, 240V/50Hz, or 230V/60Hz AC adapter, $35 each; carrying pouch, $29.95; carrying case, $59.95; black ink cartridge, $25; letter-size transparency film, 50 sheets, $50. Dimensions (HWD): 13.0 x 15.6 x 12.3 inches. Weight: 4.3 pounds; with battery and AC adapter, 6.3 pounds; with battery, AC adapter, and sheet feeder, 7.0 pounds. Emulations: Canon BJ-10e, Canon BJ-130e, Epson LQ, IBM Proprinter.*

Canon Bubble Jet Printer BJC-800 *List price: $2,795. Black ink cartridge, $25; cyan, magenta, or yellow ink cartridge, $34.95 each; letter-size transparencies, 50 sheets, $50; letter-size coated paper, 200 sheets, $19.95; legal-size coated paper, 200 sheets, $29.95; ledger-size coated paper, 200 sheets, $39.95. Dimensions (HWD): 11.0 x 20.5 x 26.6. Weight: 22.0 pounds. Emulations: Epson LQ.*
Circle 530 on reader service card.

Digital Equipment Corp.

DECmultiJET 2000

BY MITT JONES

The DECmultiJET 2000 ($539) not only emulates the HP DeskJet Plus and looks something like it but also benefits from an HP technology license. The 300-dpi plain-paper printer uses the same 50-nozzle printhead design as the HP DeskJet models and can use HP print cartridges.

This is Digital's second ink jet for the PC market. It introduced its first, the $329 DECmultiJET 1000 (formerly the DECjet 1000) last year (reviewed in our August 1992 issue). The DECmultiJET 1000 looks identical to Olivetti's Royal CJP 450, reviewed here.

DECmultiJET 2000

The DECmultiJET 2000 distinguishes itself with its optional paper-handling accessories. Buyers who need more than the standard 150-sheet cut-sheet feeder can choose a $199 150-sheet bin or a $149 external push tractor attachment. But loading continuous feed paper can be a challenge: You must tilt the machine by its front well off the attachment, and the sprocket covers don't flip up to allow easy threading of paper.

Like HP's DeskJet printers, the DECmultiJET 2000 uses retractable wings to separate emerging cut sheets from the output stack. But several times during testing, the rear left corner of the emerging page didn't fall away from the left wing, causing a paper jam when the next page began to exit.

From the DECmultiJET's control panel, you can navigate around the paper-based configuration routine, thereby dispensing with the usual DIP switches; you can also select font and print mode. But don't buy this printer for its control panel: Several oddities of the panel's layout and labeling render operation confusing.

The DECmultiJET offers a Windows driver, but it proved too buggy to use for testing. Windows' HP DeskJet Plus driver worked better. Digital now has an upgrade that it says fixes the speed and quality problems we had.

The DECmultiJET 2000, which clocked in at a respectable 60 characters per second in quality mode during testing, compares with the HP DeskJet mod-

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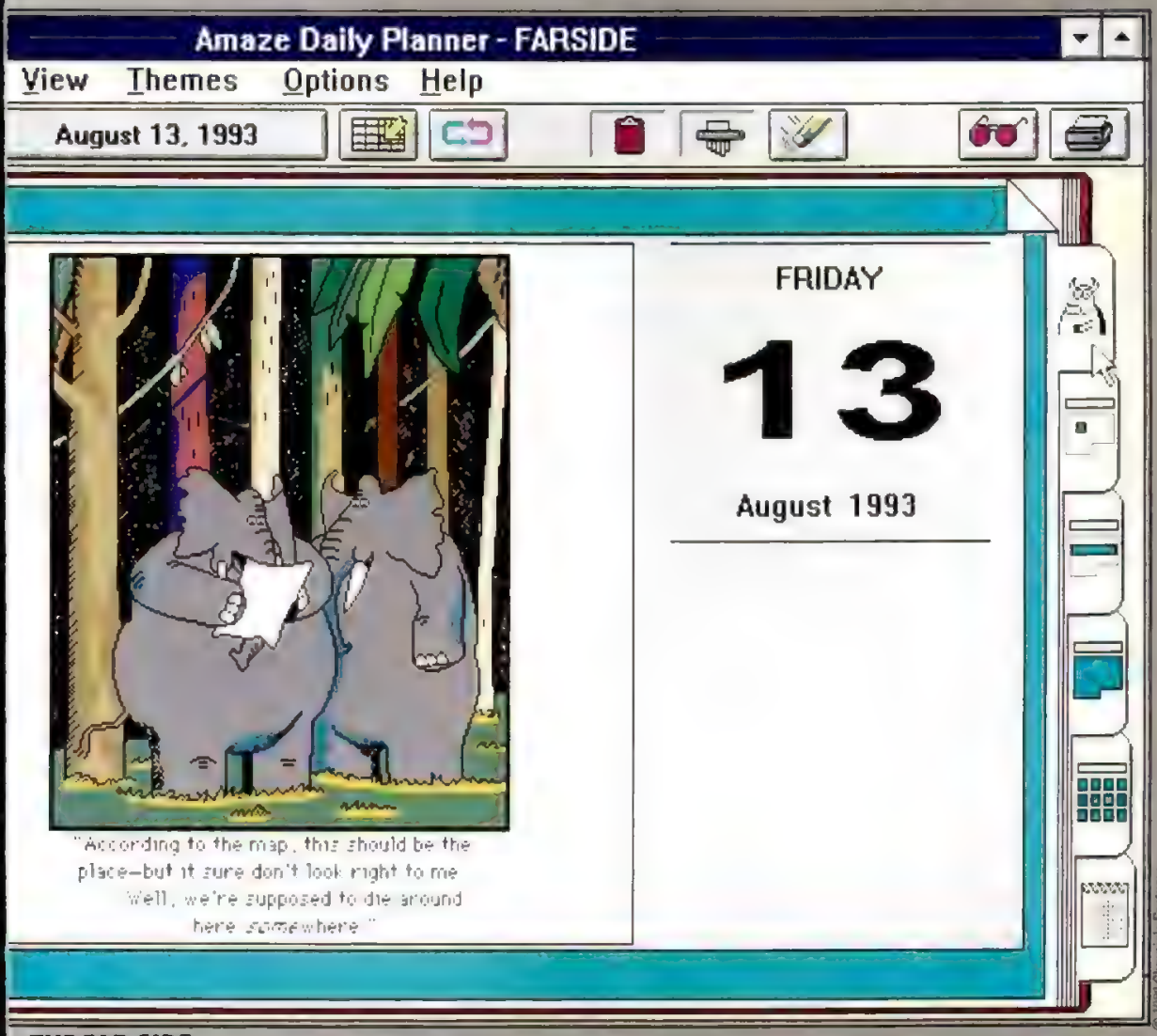


THE FAR SIDE Now it's as near as your personal computer. Gaze into your screen and savor a daily dose of dementia straight from the mind of Gary Larson. Volume II is just as funny as Volume I, if that's possible. And once a week, it's in color!

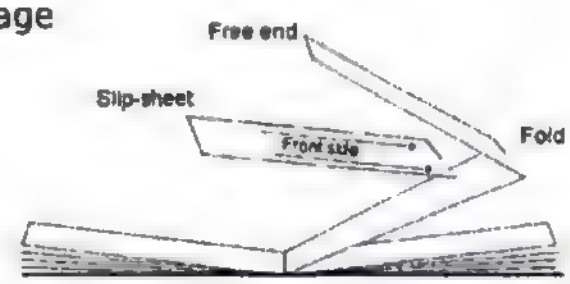
Folded edge of the page

Inverted Foldout slip-sheet

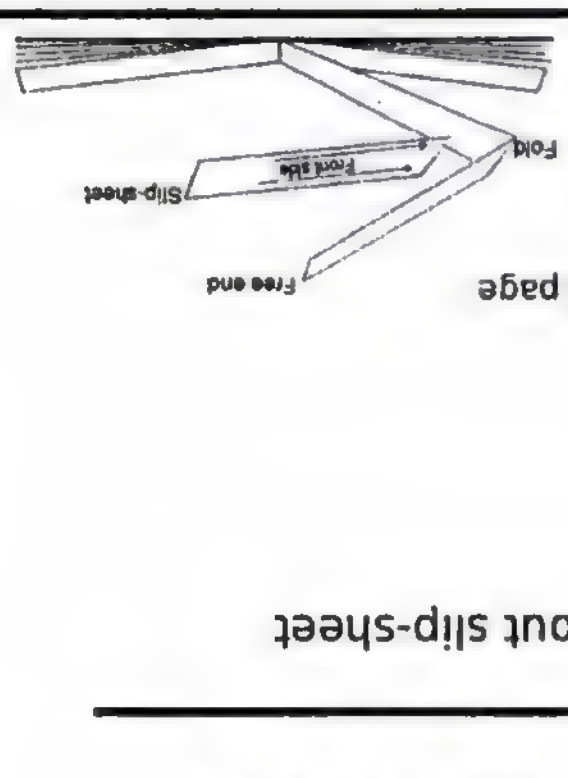
GbsSlipSheet-001

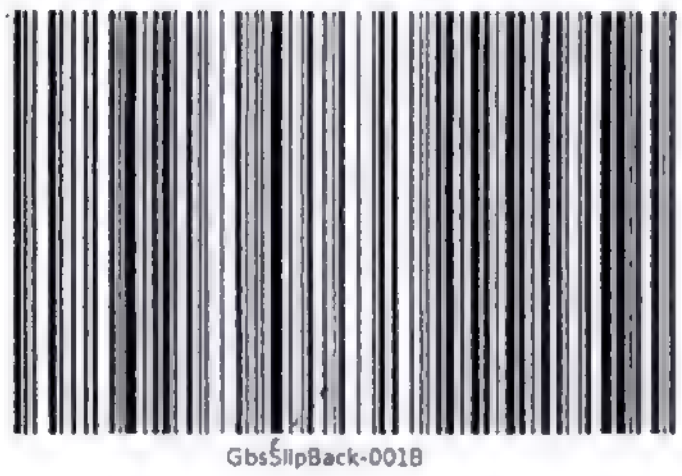
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Open the foldout page
2. Insert this sheet with
1. Front side touching the free page
2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



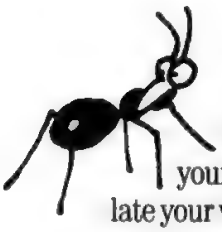


Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side



Does having a blast with your personal computer violate your work ethic?

When faced with bizarre, disturbing, yes, even sick humor, do you become confused and disoriented?

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Do you think cellulite is something they use to make movies?

Perhaps you should skip to the back page.

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As you'll see on the back, the Amaze Daily Planners are fully functional, multi-featured, perpetual personal organizing systems.

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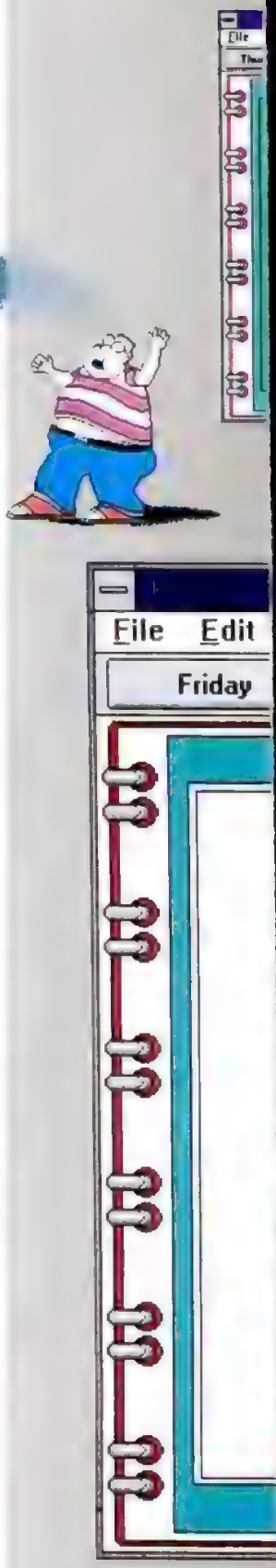
*Genus® Editions.



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Come on, admit it.

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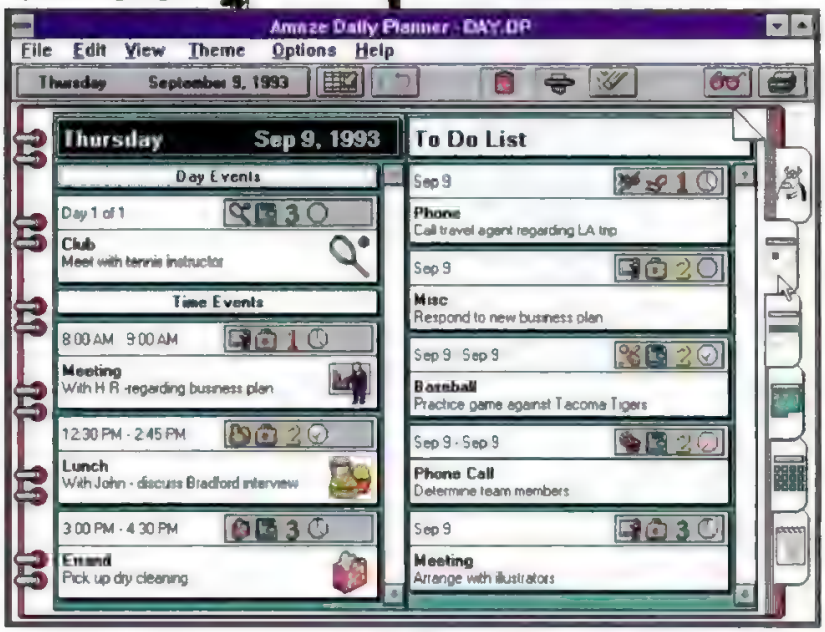

It's as easy as click and drag.

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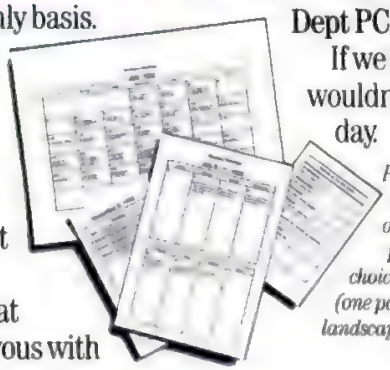
Speaking of tasks you'll like, how about calling 800-395-1546 Dept PCM5.

If we were you, we wouldn't wait another day.



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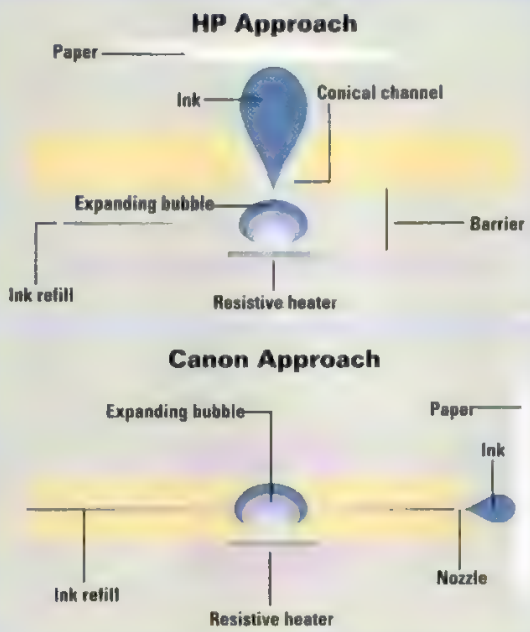
Bubble Jet Printing: *Sizzle, Steam, and Squirt*

by Mitt Jones

Chalk up another bit of progress to chance and human error: In the 1970s, a Canon researcher reportedly discovered the process behind bubble jet printing when he accidentally touched an ink-filled syringe with a hot soldering iron. Subsequent investigations into why this happy bungle caused ink to shoot from the syringe eventually led to Canon's Bubble Jet line and every other ink jet printer reviewed here.

All seven ink jet printers in this review employ drop-on-demand bubble jet technology. With bubble jet printers, an electrical current passed through a small resistor heats the ink in each tiny tube. As the ink heats, the portion near the heater vaporizes and expands, pushing a drop of ink from the nozzle. The bubble then contracts, which creates a drop in pressure that pulls more ink into the tube.

The process occurs thousands of times per second during printing. Bubble jet technology has a clear edge over its drop-on-demand competitor, piezoelectric technology (which relies on mechanical force to push the ink from the nozzles), for many reasons. Bubble jet printheads are simpler mechanically—with no moving parts—and less expensive to manufacture. Bubble jet technology also permits more nozzles to be packed into a given space, which makes it possible to achieve a higher print resolution.



The Canon printers' implementation of bubble jet technology and that of the others reviewed here—which use Hewlett-Packard's approach—differ primarily in the placement and orientation of each resistive heater. Canon's design, which places the heater farther from the actual nozzles (toward the rear of each tube), allows the nozzles to be packed somewhat more closely together at the printhead. This advantage at least partially accounts for the Canons' higher 360-dpi resolution. Hewlett-Packard, however, reports that its approach provides for faster firing of the nozzles. □

els in print quality and offers a few tempting features, but its rough edges detract from the package as a whole. If you want quiet ink jet printing on continuous-feed operation, the Canon BJ-300 and BJ-330 (reviewed in last year's printer issue, November 26, 1991) offer more convenient paper handling and twice the print speed. With a not-so-low list price of $539, this printer's main advantage is its one year of next-day on-site service.

Digital Equipment Corp., *146 Main St., Maynard, MA 01754-2571; 800-344-4825; fax, 800-524-5694*

DECmultiJET 2000 *List price: $539. 256K RAM upgrade (for font downloading), $199; 150-sheet single-bin sheet feeder, $199; external push tractor, $149; A4- or legal-size paper tray, $69 each; additional font cards, $99 or $199; Epson FX 850 or IBM Proprinter 4201/4202 emulations, $149 each; black ink cartridge, $20; parallel cable, $19. Dimensions (HWD): 14.4 x 16.7 x 17.0 inches. Weight: 19.6 pounds. Emulations: HP PCL 3. Circle 532 on reader service card.*

Hewlett-Packard Co.

HP DeskJet 500C
HP DeskJet 550C
HP PaintJet XL300

BY MITT JONES

Need a little color? Need a lot? The best value going may well bear the Hewlett-Packard Co. label. The HP DeskJet 500C ($779), HP DeskJet 550C ($1,099), and HP PaintJet XL300 ($3,495) all work wonders with color ink, generate text and graphics at resolutions as high as 300 dots per inch, and produce attractive results even on plain paper.

The HP DeskJet 500C has its problems, but the printer offers good value for those who need mostly high-quality monochrome printing and a page of graphics on occasion. The DeskJet 550C is better suited to more-intensive graphics printing; it addresses most of the DeskJet 500C's problems for only $300 more.

At the top of Hewlett-Packard's impressive ink jet line, the $3,495 HP PaintJet XL300 closely matches the color quality of some printers costing two times as much or more. It works its magic on paper as wide as 11.7 inches and accepts numerous heady options, including network interface cards and a $1,995 Adobe PostScript Level 2 upgrade. HP lists the XL300, with its Pantone certification, at $4,995 with the factory-installed PostScript option and 6MB of RAM—about half what you might pay for some high-end PostScript printers with comparable color quality. (The PostScript option was not shipping in time for evaluation.)

HP DESKJET 500C

The HP DeskJet 500C, with street prices as low as $550, is like the venerable $599 HP DeskJet 500 (which we awarded Editors' Choice in our November 13, 1990, printer issue), but with color. Because it is an adaptation of a monochrome unit, the 500C accepts only one print cartridge

▶ SUMMARY OF FEATURES

Ink Jet Printers

Products listed in alphabetical order

■ = YES □ = NO

	Canon Bubble Jet Printer BJ-20	Canon Bubble Jet Printer BJC-800	DECmultiJET 2000	HP DeskJet 500C	HP DeskJet 550C
List price	$599.00	$2,795.00	$539.00	$779.00	$1,099.00
Physical characteristics					
Carriage size	Narrow	Wide	Narrow	Narrow	Narrow
Number of jets	64	64	50	50 (black), 48 (color)	50 (black), 48 (color)
Maximum resolution (dpi)	360 x 360	360 x 360	300 x 300	300 x 300	300 x 300
Color capability	□	■	□	■	■
Installed memory	37K	7K	8K	48K	80K
Parallel/serial interface	■□	■□	■□	■□	■□
Printer-specific Microsoft Windows 3.1 driver available	□ (included)	■ (included)	■ (included)	■ (included)	■ (included)
Paper handling					
Rated maximum paper weight (pounds)	28	24	36	24	36
Media supported:					
Card stock	■	□	■	□	□
Transparencies	■	■	■	■	■
Envelopes	■	■	■	■	■
Pressure/tractor paper feeds	■□	■□	■/Optional	■□	■□
Paper paths	Top L, top U, bottom vertical	Front L	Rear L; bottom L (with optional push tractor)	Front U	Front U
Landscape printing	□	□	■	■	■
Typefaces					
Courier	■	■	■	■	■
Gothic	□	□	■	■	■
Orator/Orator S	■■	□□	□□	□□	□□
Prestige Elite	■	□	□	□	□
Sans serif/Univers	■□	■□	□□	□□	□□
Script	■	□	□	□	□
Times Roman/CG Times	■□	■□	■□	■□	■□
Includes scalable fonts	□	□	□	□	□
Control panel					
Buttons:					
Emulations	■	N/A	□	N/A	N/A
Form feed	□	■	□	■	■
Line feed	□	□	□	□	□
Paper parking	N/A	N/A	■	N/A	N/A
Print mode	■	■	■	■	■
Typeface selection	■	■	■	□	□
"Ink cartridge low" indicator	□	■	□	□	□
Customer support					
Toll-free technical support	■	■	■	□	□
Telephone support hours (eastern time)	9:00 A.M.–9:00 P.M. M–F	9:00 A.M.–9:00 P.M. M–F	24 hours a day	9:00–8.00 M, T, Th, F; 9:00–6:00 W	9:00–8:00 M, T, Th, F; 9:00–6:00 W
24-hour BBS	■	■	□	□	□
Warranty (parts and labor)	2 years	2 years	1 year	3 years	3 years

* The Windows driver was not available for testing

N/A—Not applicable: The product does not have this feature

	PC EDITORS' CHOICE	
	HP PaintJet XL300	**Royal CJP 450**
	$3,495.00	$499.95
	Wide	Narrow
	50	50
	300 x 300	300 x 300
	■	□
	2MB	10.5K
	■□	■□
	■ (included)	■ *
	24	24
	■	■
	■	■
	□	■
	■□	■□
	Front U	Front L; bottom S (with optional sheet feeder)
	■	■
	■	■
	□	■
	□□	□□
	□	□
	□■	□□
	□	□
	□■	□□
	■	□
	N/A	□
	■	■
	□	■
	N/A	N/A
	□	□
	□	□
	□	□
	□	■
	9:00–8:00 M, T, Th, F; 9:00–6:00 W	8:30–6 M–F
	□	□
	1 year	1 year

ENDS

at a time: black or tricolor. When you need color output, you remove the 50-nozzle black cartridge and install the tricolor cartridge, which uses 16 nozzles per color.

The 500C is not a wise choice if you want to embed color graphics into text documents: To print black with the color cartridge installed, the printer must create a composite black by overlaying the cyan, magenta, and yellow ink. The process can be slow and produces a greenish black.

HP DeskJet 500C, HP PaintJet XL300, HP DeskJet 550C

Printing on plain paper, the 500C produced color graphics that were true, fairly vibrant, and band-free. Monochrome quality falls slightly short of a 300-dpi laser, with minimal to moderate banding in some graphics samples.

Colors took on considerably more depth when printed on HP CX JetSeries coated paper, which costs about 10 cents per page. Unlike the Canon BJC-800, the DeskJet 500C does not require coated paper to achieve its best monochrome printing. In fact, HP recommends that you do not print on coated paper with black ink.

HP includes a feature called "complex color printing" in its Windows driver for all three printers. This feature, which consistently and considerably improved the quality of our color test images, uses HP algorithms to generate colors that approximate those displayed on your screen.

Oddly enough, the Windows driver does not support the printer's resident bitmapped fonts, cartridge fonts, or downloadable fonts. Instead, the driver offers its own scalable font outlines in Courier, Univers, and CG Times. To avoid the performance hit of using the scalable fonts, you'll have to switch to the HP DeskJet Family driver shipped with Windows itself, which—you guessed it—does not support color printing.

The DeskJet 500C, which turned out 71 characters per second in quality mode on our performance tests, was a leader in the field (along with the 550C) in all speed trials. The 500C's winning score of 1.9 graphics pages per minute was a hair's breadth faster than the 550C's 1.7 gppm.

The 500C's sheet feeder holds as many as 100 sheets of letter-, legal-, or A4-sized paper, and a manual feed accepts No. 10 envelopes.

The ink in the 500C's tricolor cartridge will smear when moistened, but the standard black ink cartridges use water-resistant ink. The black print still smudges if you run a wet finger across it, but you won't get the wholesale smearing expected with most ink jet printers.

While the DeskJet 500C has its disadvantages, it should still appeal to those who want respectable color output cheap.

While the DeskJet 500C has its disadvantages—in particular its inability to print with black and color ink on the same page—it should still appeal to those who want respectable color output on the cheap.

HP DESKJET 550C

The DeskJet 550C takes most of the design and features of the DeskJet 500C and improves on them. Expected to carry street prices as low as $750, the printer looks much the same as its year-old sibling and accepts the same cartridges and consumables. It also performs at approximately the same brisk rates.

The printhead carriage on the 550C accepts both black and tricolor cartridges side by side, and the printer supports use of the two simultaneously. Unfortunately, the DeskJets' black ink doesn't

We've brought n
the expression,

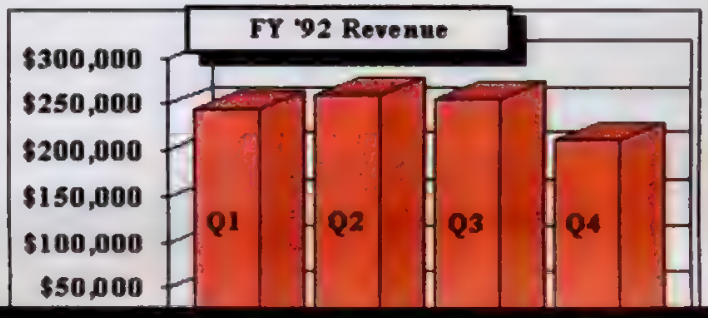
Microsoft Mail - [FY '92 Revenue]

File Edit View Mail Window Help

Compose | Reply | ReplyAll | Forward | Move | Delete | Previous

From: Coleman Barney
Date: Fri, May 22, 1992 11:57AM
To: Mike Delman
Cc: Alicia Anderson
Subject: FY '92 Revenue

As we discussed, here's the chart, by quarter, for this year's gross revenue. I've also included my sales spreadsheet SALES.XLS and quarterly report REPORT.DOC for your review. Please listen to my comments concerning the Christmas and Spring Break promotions offered to college students. Despite the increased sales volume these promotions represented, I don't think we should repeat them, given the amount of damage our boats sustained from this rowdy group of kids.



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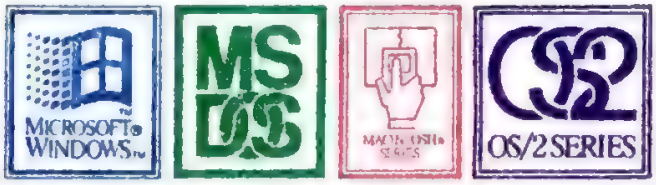
ew meaning to "It's in the mail."

Furthermore, you can send mail while you are working in another software program. Like, say from your word processor or spreadsheet.



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Microsoft

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fare well on coated paper: For text with embedded graphics, you'll have to settle with plain-paper color graphics quality.

Other notable improvements over the 500C include the redesigned sheet feeder, which now accepts a stack of as many as 20 envelopes and benefits from an improved paper-width adjustment.

Finally, the DeskJet 550C includes a switch setting that determines if expansion RAM will add to the receive buffer or be used for font downloading. The 500C uses expansion memory only for font downloading.

The PaintJet's printing process improves image quality, but exacts a considerable penalty in speed.

The early production unit we received performed well for the most part during our testing, until the black text began to print somewhat smeared. Once we replaced the high-capacity ink cartridge provided with the unit, output quality returned to normal. Color output was equally impressive on this unit, though it seemed more prone to banding problems on both color and monochrome graphics samples than the 500C, particularly under Windows. HP attributed this to a faulty color cartridge.

The 550C solves many of the 500C's shortcomings for plain-paper output. It shares the 500C's inability to produce quality black output on coated paper but is otherwise worth the higher price.

HP PAINTJET XL300

With a list price of $3,495 and slug-fast operation, the HP PaintJet XL300 isn't for everyone. As a shared color graphics printer for jobs where only top color quality will do, however, the Pantone-certified XL300 offers terrific value. The PaintJet XL300 does an excellent job in mixed and networked environments and, with its built-in support of HPGL/2, it also doubles as a color plotter.

The XL300 employs a 50-nozzle printhead/ink combination cartridge for each the black, cyan, yellow, and magenta inks. It utilizes all four ink cartridges simultaneously.

The XL300's rich, vibrant colors and the smooth image texture are impressive, even on plain paper. With HP's coated paper and special paper, color quality falls little short of astounding for ink jet technology. Color quality for transparencies is also noteworthy. Text characters are close enough to laser quality to suffice for a great majority of applications.

The PaintJet XL300 achieves its remarkable color in part through two heating systems. One heater warms the media before it reaches the printheads to reduce moisture and to make it more absorbent. A second grill heater dries the ink as the page exits the printer. This process improves image quality by allowing the printer to apply more ink without causing bleeding or pooling. Unfortunately, it exacts a considerable penalty in speed.

The feed mechanism, which required more than 6 minutes just to feed ten pages, pauses to allow the media time to heat. During tests of print speed in HP PCL mode, the XL300 clocked in at a miserable 19 cps in quality mode and 0.3 gppm with monochrome graphics.

The XL300 marks the first implementation of Hewlett-Packard's PCL 5C printer language, which adds color extensions of text and raster and vector graphics to the features of PCL 5. The printer employs an Intel 80960 RISC processor and comes with 2MB of RAM, of which 20K serves as a receive buffer and 800K is available to the user.

The 800K will suffice for printing bitmapped graphics—the HP drivers will simply send the data to the printer in bands—but each page that uses PCL 5C or PostScript page description commands must be able to fit the bitmapped form within this 800K region. In other words, the printer then functions as a page printer, and you'll probably need more memory for heavy graphics use.

A covered compartment at the right front of the printer accepts an optional $149 memory board or the $1,995 Adobe PostScript Level 2 Upgrade Kit. The upgrade includes 4MB of RAM. Either board allows memory expansion to as high as 18MB via two SIMM slots.

The XL300 provides CG Times, Courier, Univers, Univers Condensed, and Zapf Dingbats resident, scalable font outlines, as well as 14 resident bitmapped fonts. Two cartridge slots accept the HP IIISi's lengthy list of bitmapped and scalable font cartridges.

HP ships the PaintJet XL300 with drivers for Windows 3.0 and 3.1 and several popular DOS applications, including AutoCAD, Versions 10 and 11. Unlike the color Windows drivers for the DeskJet models, the PaintJet XL300 driver supports resident bitmapped and cartridge fonts. HP has built in the same proprietary color matching scheme used in the DeskJet drivers, plus support for Pantone-approved colors within Pantone-licensed applications.

The XL300 supports simultaneous connections via its parallel port, AppleTalk/RS-422 port, and any of HP's JetDirect interface cards, which allow direct connection to numerous networks. The printer automatically switches to the hot port. The printer also automatically switches between PostScript and PCL 5C printer languages.

One drawback of most ink jet printers applies in particular with the PaintJet: The black plain-paper output is prone to smearing. Unlike the DeskJet models, the XL300 does not use water-resistant ink, not even for black print.

The manual feed of the XL300 allows use of all supported media sizes—paper as wide as 11.7 inches—and the standard feed tray accommodates as many as 200 sheets of A4-, letter-, or legal-size paper. Additional trays cost $129 to $149, if you need automatic feed of A3-, B-, or B4-size media.

The PaintJet XL300's slow performance and the output's tendency to run heavily when moistened are drawbacks. Even so, the HP PaintJet XL300 offers the best value by far if you need laser-quality, large-media color output in a single-user or shared environment.

Hewlett-Packard Co., *Direct Marketing Organization, P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051-8059; 800-752-0900; fax, 208-344-4809.*

HP DeskJet 500C *List price: $779. 256K RAM upgrade, $175; additional font cards, $79 or $140; Epson FX, $79; black ink cartridge, $21.95; high-capacity black ink cartridge, $31.95; tricolor ink cartridge, $34.95; letter-size coated paper, 200*

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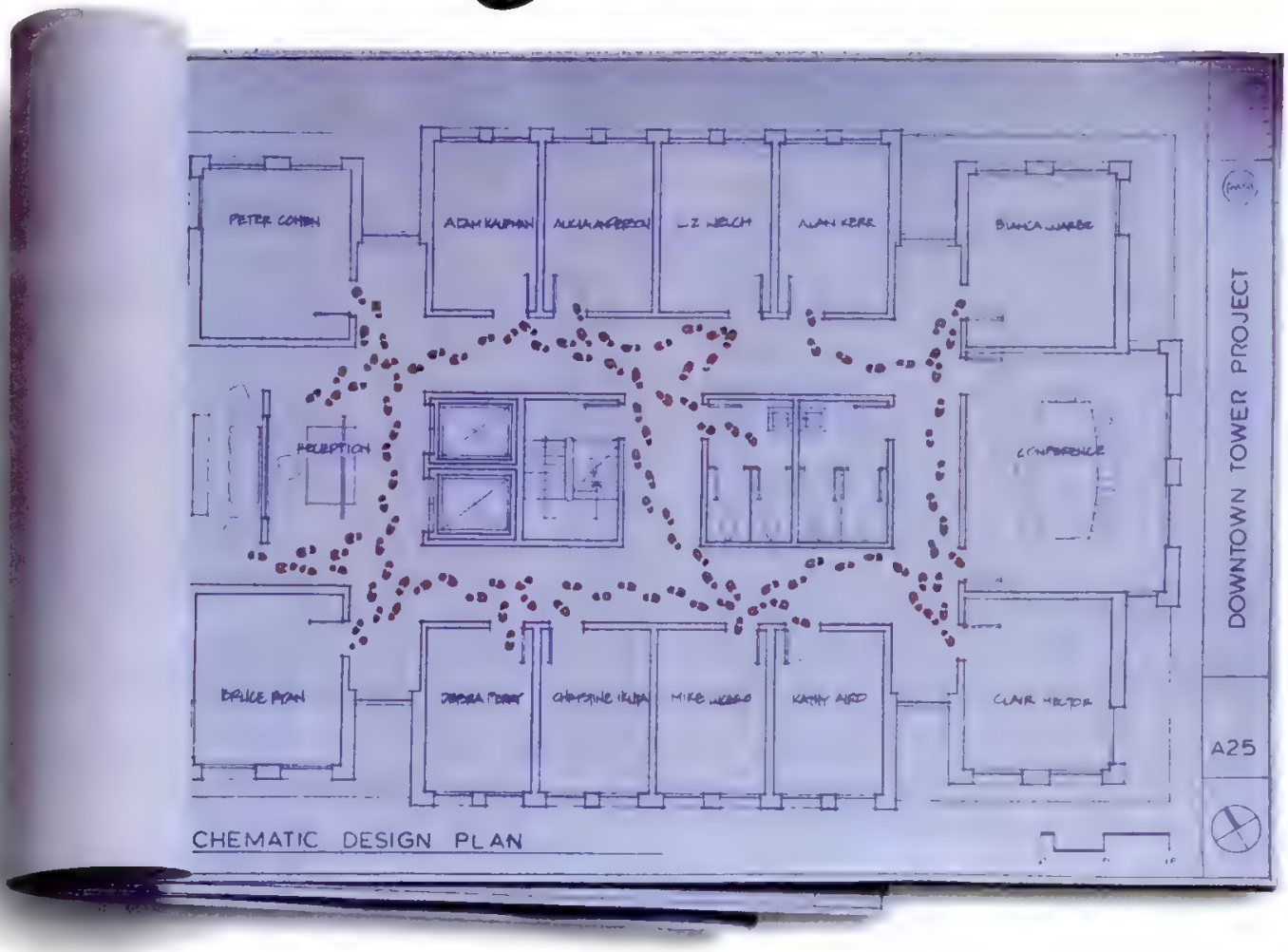

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sheets, $20.95; letter-size glossy paper, 50 sheets, $59.95; letter-size transparencies, 50 sheets, $55.95. Dimensions (HWD): 8.0 x 17.3 x 14.8 inches. Weight: 14.3 pounds. Emulations: HP PCL 3.

EDITORS' CHOICE ▶ HP DeskJet 550C *List price: $1,099. 256K RAM upgrade, $175; additional font cards, $79 or $140; Epson FX emulation, $79; consumables are the same as for the DeskJet 500C. Dimensions (HWD): 8.2 x 17.5 x 15.3 inches. Weight: 14.5 pounds. Emulations: HP PCL 3.*

EDITORS' CHOICE ▶ HP PaintJet XL300 *List price: $3,495; with Adobe PostScript Level 2 and 6MB RAM, $4,995. 0MB RAM upgrade, $149; 4MB RAM upgrade, $599; 1MB SIMM, $169; 4MB SIMM, $499; 8MB SIMM, $898; 200-sheet A3-size paper tray, $149; 200-sheet B-size paper tray, $149; 200-sheet B4-size paper tray, $129; additional font cartridges, $195, $249, $300, or $325; Adobe PostScript Level 2 Upgrade Kit, $1,995; black ink cartridge, $21.95; cyan, magenta, or yellow ink cartridge, $24.95 each; letter-size coated paper, 200 sheets, $20.95; B-size coated paper, 200 sheets, $44.95; letter-size glossy paper, 50 sheets, $59.95; letter-size transparencies, 50 sheets, $55.95; NetWare Ethernet interface, $695; LAN Manager Ethernet interface, $695; NetWare Token-Ring interface, $895; LAN Manager Token-Ring interface, $895; AppleTalk EtherTalk interface, $695; Dimensions (HWD): 10.1 x 30.3 x 21.2 inches. Weight: 45.0 pounds. Emulations: HPGL, HP PCL 5C.*
Circle 531 on reader service card

Royal Consumer Business Products

Royal CJP 450

BY MITT JONES

Royal Consumer Business Products, a division of Olivetti Office USA, makes its debut in the printer market with the Royal CJP 450 ($499.95). As with the DECmultiJET 2000 reviewed here, this 300-dot-per-inch, plain-paper printer uses the same 50-nozzle printhead technology as the HP DeskJets, as well as HP DeskJet print cartridges.

The CJP 450 looks identical to the DECmultiJET 1000 reviewed in our August 1992 story on portable printers, and for good reason: Olivetti reportedly manufactures both. The 6.3-pound printer is compact enough to be used as a portable (4.5 by 13.5 by 5.75 inches in travel position), but it has no battery pack. Royal positions the printer more as a low-cost, space-saving desktop printer for home-office or small-business use. The CJP 450 accepts a 70-sheet automatic sheet feeder ($99.95). The feeder worked well throughout testing.

The most memorable aspect of this printer is a bank of 33 thumb switches that substitute for multilevel control-panel menus; excellent labelling makes finding the appropriate switch a cinch. The one drawback is that you must toggle the power switch to activate new settings.

The printer, which tested at a restrained 46 cps in quality mode, compares well in print quality, though it was prone

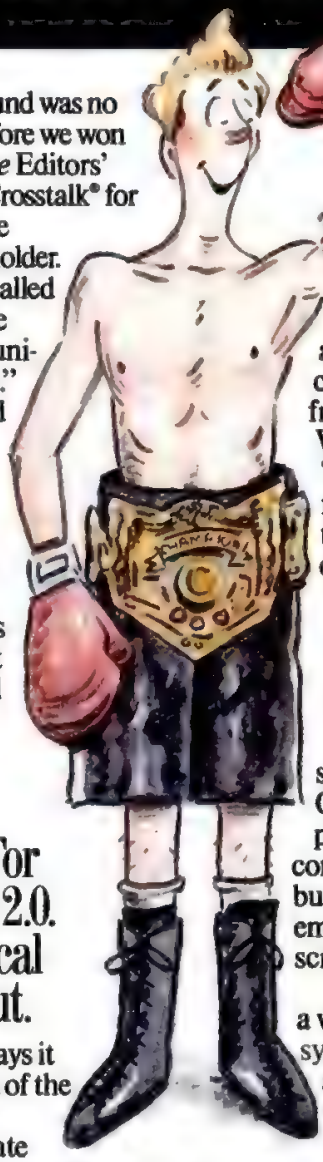
to banding with graphics.

Typically priced at $449 on the street (including the sheet feeder), the printer delivers the features most users would need in a low-cost, small-footprint desktop. The HP DeskJet 500, which can be found on the street for $400 or less, still rates as the better buy for users who need near-laser, monochrome output. But if you can catch the CJP 450 at a bargain, it will do the job just fine. □

Royal Consumer Business Products, *765 U.S. Hwy. 202, Bridgewater, NJ 08807-0945; 800-527-2960; 908-526-8200; fax: 908-526-8405.*

Royal CJP 450 *List price: $499.95. 128K RAM upgrade (for font downloading), $129.99; 256K RAM upgrade (for font downloading), $184.99; 70-sheet single-bin sheet feeder, $99.95; additional font cards, $79 each; Epson FX and IBM Proprinter emulations, $149.95 each; black ink cartridge, $19.95. Dimensions (HWD): 11.2 x 13.5 x 13.2. Weight: 6.3 pounds. Emulations: HP PCL 3.*
Circle 533 on reader service card

The Heavyweight Champion Of Windows Comm Software Just Became Even More Of A Knockout.



The first round was no contest. Long before we won the *PC Magazine* Editors' Choice Award, Crosstalk® for Windows was the undisputed title holder. *Software Digest* called it the "best of the graphical communications packages." *InfoWorld* named it "Product of the Year." And it won the *Windows Magazine* Readers' Choice Award.

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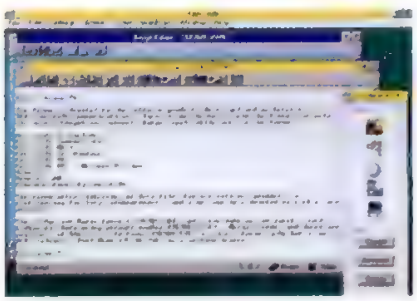

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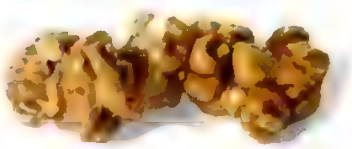

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DOT MATRIX

A Niche, in Time

With laser and ink jet prices falling, why buy an impact printer? Multipart forms, high-volume draft printing, and labels are good reasons and the prime territory these machines have carved for themselves.

by Bruce Brown

Who cares if laser printers deliver a better print quality at faster speeds than dot matrix printers can? Frankly, a lot of people do. But dot matrix printers are cheap, and for the home market, small businesses on tight budgets, or users who need draft-producing personal printers as companions to networked lasers, that's endorsement enough.

The 35 dot matrix printers we reviewed here start as low as the 24-pin $299 Epson ActionPrinter 3250 and the 9-pin Panasonic KX-P2180, which carries the same list price. Street prices are even more enticing: You can pick up the ActionPrinter for around $210 and the KX-P2180 for as little as $160. A number of the standard 9-pin printers we reviewed have street prices estimated somewhere from $100 to $200, while you can usually buy the higher-quality, 24-pin devices we looked at for a price ranging between $200 to $400.

In 1991, for the first time ever, 24-pin printers outsold 9-pin printers, according to BIS Strategic Decisions. But make no mistake; while there is still a need for dot matrix printers, the market as a whole is getting smaller. According to BIS, just over five million dot matrix printers were sold in the U.S. last year; this number is slightly lower than the 5.3 million that were sold in 1990.

Part of the reason is the continuing competition from low-end lasers, which can sell for as little as $700 on the street. Additionally, list prices for desktop monochrome ink jets have fallen to around $500 in the last year, and there is still room to drop. The price decrease, combined with their quality output and quiet operation, makes ink jets attractive for the small office and home business markets that dot matrix printers have always been so attractive to.

Low-end 24-pin units, which have little remaining space for price decreases, will particularly feel the squeeze. BIS predicts that with the strong ink jet market, dot matrix sales will slip to 4.9 million in 1992 and 4.5 million in 1993.

STILL STANDING

Ink jets or even low-end lasers can't totally re-

Photograph by Scott Wippermann

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place dot matrix printers, though. For applications that require paper-handling versatility or high-production power, dot matrix printers are still an important force.

For instance, impact printers remain the only viable means for printing multipart forms. Dot matrix devices are also the most cost-effective and convenient choice for printing labels. Single-sheet label stock for cut-sheet laser printers can retail for as much as $35 for a box of 3,000 labels, versus about $20 for a box of 3,000 dot matrix labels.

Speedy wide-carriage printers with flexible paper handling are required in accounting and data processing environments, where spreadsheet data can stretch beyond an 8.5- by 11-inch page. Among the wide-carriage products reviewed here are those suitable for both light- to moderate-volume printing, typically listing for $500 to $1,000, as well as for heavy-duty high-production applications. The systems for heavy use, including a 9-pin unit from Okidata; 18-pin offerings from ALPS America, Brother International Corp. USA, and Unisys Corp.; and even a 24-pin product from Fujitsu Computer Products of America, are generally priced from $2,000 and $3,500, with street prices as low as $1,200.

Today, dot matrix models like these are still the most cost-effective choices for printing documents like wide-carriage spreadsheets. Many B-size (11- by 17-inch) lasers cost upwards of $5,000, though that is starting to change. Dataproducts dropped its prices for its LZR 1555 and LZR 1560 to $3,395 as we went to press. Additionally, the CalComp CCL 600 and the QMS 860 Print System were scheduled to ship this quarter at list prices of $3,995 and $4,595, respectively.

Higher up on the dot matrix price scale are products suited for the most intensive text printing applications: line printer emulators. In most cases, you won't choose these for the quality of their output but for their speed—as many as 500 lines per minute. Unlike true line printers, these systems don't print an entire line of characters at a time. The Genicom 4440 XT comes closest to a true line printer; it has a single line of 66 hammers stretching across the entire platen, enabling it to print a complete line of dots in one shot.

The other three products in this category—the Dataproducts LX 455, OTC Euroline 400, and OTC Euroline 600—rely instead on movable printheads.

At $4,595, the Dataproducts LX 455 is the least expensive of this group (which in this article we'll refer to as line printers). The $7,795 unit from Genicom Corp. is the most costly. All would be comfortable attached to a server for no-nonsense printing tasks.

ADVANTAGES AND IMPROVEMENTS

Dot matrix printers have the advantage of low consumable costs—especially when compared with those of ink jets. Per-page costs can vary with the print mode, ribbon cost, and ribbon life, but in general, dot matrix print jobs cost from 0.3 to 1.6 cents per page of text. In comparison, ink jets typically cost 6 to 10 cents per page of text.

Although the quality of dot matrix output can't match that of lasers or ink jets, units from Fujitsu and Panasonic

HIGHLIGHTS

Dot Matrix Printers

LASER AND INK JET printers deliver better-quality output than dot matrix printers, and lasers are also faster. But only dot matrix systems can have street prices of $200 or less.

THOUGH DOT MATRIX systems are still good choices for general use, the price gap between these units and ink jet printers is shrinking. This, plus continuing competition from low-end lasers printers, could push dot matrix printers further into niche markets.

A LOW CONSUMABLE cost is a plus for dot matrix printers: only 0.3 to 1.6 cents per printed text page. Ink jet units typically cost from 6 to 10 cents per page in their highest-quality modes.

FOR TEXT SPEED, the Unisys AP 1371 led the 9- and 18-pin printers, while the Fujitsu DL5800 Power PrintPartner was the quickest of the 24-pin printers. The line printer emulators were by far the fastest, led by the OTC Euroline 600, with 500 lpm in wide-carriage draft mode.

THE 24-PIN Mannesmann Tally MT150/24 and MT151/24 produced graphics faster than any of the other dot matrix printers tested: 2.6 gppm.

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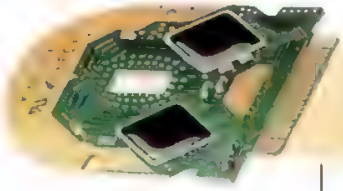

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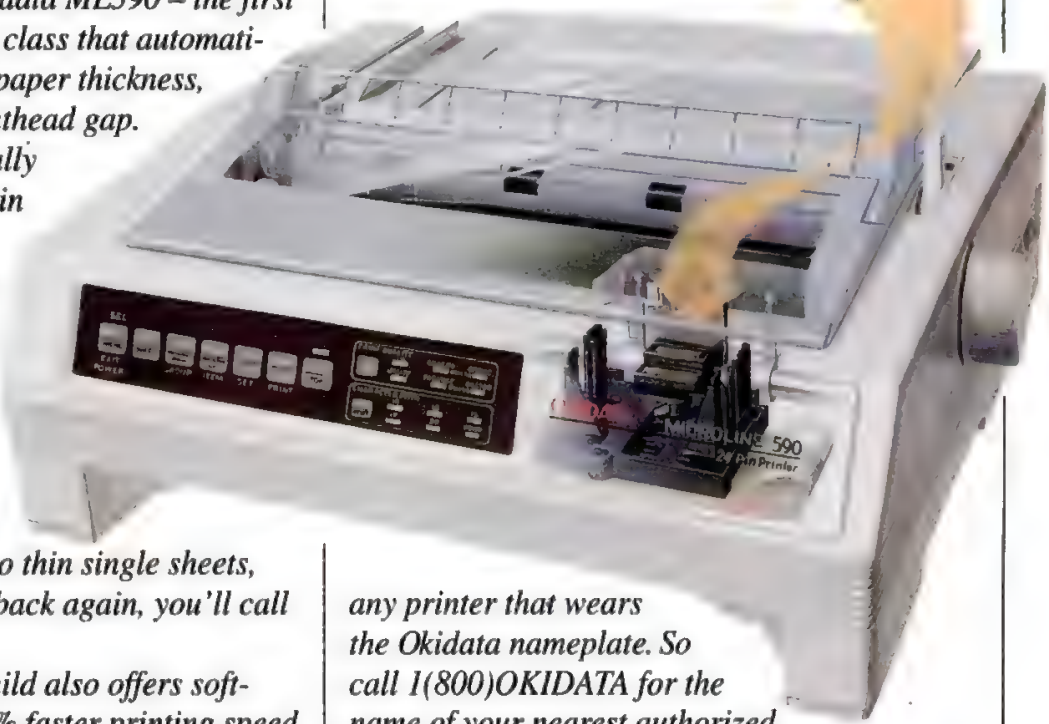

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CIRCLE 235 ON READER SERVICE CARD

EDITORS' CHOICE

- **18-pin: Unisys AP 1371**
- **24-pin: C. Itoh ProWriter C-615II Document Printer, Fujitsu DL5800 Power PrintPartner, Panasonic KX-P2124, Star Micronics NX-2430 Multi-Font**
- **Line printer: OTC Euroline 600**

Today, most 9-pin and 24-pin dot matrix printers still hold appeal for general-purpose use but mostly for the home or small-business user, whose first consideration is cost. Only in the dot matrix market can you find printers with street prices of $200 or less. And some of the better narrow-carriage units are available for about $250 to $300, still well below the $700 street price of low-end laser printers like the Epson ActionLaser II and at least $100 less than the $400 street price of the venerable HP DeskJet ink jet printer. But the price gap continues to close, so anyone with a little more to spend should thoroughly consider all the options before settling on a dot matrix for general-purpose print jobs.

When it comes to specialized print jobs, however, dot matrix printers can't be beat. For one thing, no other technology can satisfy those who require multipart forms printing. And while the prices of B-size (11- by 17-inch) lasers have started to come down past the $5,000 mark, wide-carriage dot matrix units suitable for low- to moderate-volume printing still cost a good deal less than most—between $500 and $1,000. And higher-end wide-carriage systems for high-production use carry list prices of around $3,000 or less.

GENERAL-PURPOSE

In this roundup, two 24-pin narrow-carriage printers earn an Editors' Choice for their ability to deliver low-cost, letter-quality printing for general-purpose business needs: the $549.95 Panasonic KX-P2124 and the $399 Star Micronics NX-2430 Multi-Font.

The KX-P2124, which sells for about $300 on the street, packs in a lot of features for the dollar. It continues in the tradition of its predecessor, the 1991 Editors' Choice–winning Panasonic KX-P2624, by offering whisper-quiet operation; this comes courtesy of a diamond-shaped printhead that fires pins sequentially rather than simultaneously.

Good performance goes hand in hand with its quiet printing; the unit managed a very respectable 61 characters per second in quality mode on our Text Speed test. A super-letter-quality mode for impressive text output and good paper handling are other pluses that you will get with this well-rounded printer.

The NX-2430 cannot compete with the KX-P2124 in speed (the Star Micronics device produced a rather droopy 45 cps in quality mode) but matches it in output quality and smooth paper handling. At $250 on the street, the NX-2430 printer will particularly appeal to the cost-conscious crowd. Other points in the NX-2430's favor are an immediately intuitive control panel and affordably priced options, including eight font cartridges ($39 each) that can add a total of 21 fonts to the printer's five resident typefaces.

WIDE-CARRIAGE WINNERS

For moderate wide-carriage printing needs, the $1,175 C. Itoh ProWriter C-

Communications & Systems Co. offer super-letter-quality printing capabilities that provide denser-than-normal print matrices to improve text output. (See the sidebar "Dot Matrix Quality: Pinning Down the Terms" for more on dot matrix print quality.)

We first saw internal scalable fonts in Epson America's line of dot matrix printers last year, but the feature hasn't really caught on. Only the Epson ActionPrinter 3250 and the Citizen GSX-240 in this year's roundup offer the capability. The ability under Microsoft Windows 3.1 to use scalable TrueType fonts makes resident scalable fonts less of an issue for many users of dot matrix printers. For non-Windows users, however, the few internal scalable fonts these systems provide is a welcome feature, even if it isn't yet revolutionary.

PERFORMANCE TEST RESULTS

Particularly for the 9-pin and 18-pin printers, we found a direct correlation between page eject speeds (how fast paper travels through the printer) and printing throughput. This indicates that printer performance is linked to the ability to advance paper through the printer and not merely to the number of pins in the printhead. The three fastest printers we saw—the ALPS DMX800, Brother M-4309A, and Unisys AP 1371—were all 18-pin printers.

The 18-pin Unisys AP 1371 dominated the 9- and 18-pin printers in terms of text speed, with a draft score of 281 characters per second and a quality score of 129 cps. The slowest 9-pin printer was the Panasonic KX-P2180, which produced 89 cps in draft mode and only 27 cps in quality mode.

For 9- and 18-pin graphics printing, the Okidata Pacemark 3410 led with 2.2 graphics pages per minute, while the Okidata Microline 184 Turbo trailed the pack with 0.5 gppm.

Of the 24-pin printers we tested, the Fujitsu DL5800 Power PrintPartner came in first in terms of text speed, with 213 cps in draft mode and 118 cps in quality mode; it also managed our Page Eject test in 17 seconds, making it the fastest printer in its category.

The slowest 24-pin model was the Tandy DMP 310 Slimline Printer (43 cps

615II Document Printer (about $775 on the street) provides reasonable text speed and quality text output. These features are packaged in an unusual, well-thought-out flatbed design that deserves to be widely copied. (The unit's narrow-carriage twin, the C. Itoh ProWriter C-610II Document Printer, offers the same benefits, but the $799 list price makes it less of a compelling choice for quality narrow-carriage printing.)

Looking more like a plotter than a dot matrix printer, the C-615II boasts strong paper-handling capabilities. The flatbed construction allows tractor-fed paper to glide along a straight paper path and out the front. The design practically guarantees protection against paper jams, and it also handles card stock and multipart forms with ease. Text speed, at 124 cps in draft mode and 59 cps in quality mode, is quite reasonable for low- to moderate-duty needs.

For higher-volume wide-carriage printing, look to the $3,295 18-pin Unisys AP 1371 and the $1,995 24-pin Fujitsu DL5800 Power PrintPartner. Both units will satisfy those who require printers for heavy-duty data processing, multipart forms, or spreadsheet work and for less than the cost of line printer emulators.

Among the 9-, 18-, and 24-pin printers, the Unisys device takes the lead in sheer speed, with 281 cps in draft mode and 129 cps in quality mode. With a resolution of 240 by 144 dots per inch, it provides decent if not the highest-quality output. Paper-handling options are expensive but plentiful; the system can accommodate 260 sheets of cut-sheet paper through two optional feeders ($660 and $400). An optional $295 push tractor lets it bottom-feed continuous forms.

The Fujitsu printer can't quite match the Unisys device for draft text printing speed, but it doesn't lag far behind, either. The DL5800 unit is also cheaper, and this 360-dpi unit provides excellent 24-pin text output. With a low street price around $1,500, the DL5800's good paper handling, speedy service (213 cps in draft mode and 118 cps in quality mode), and high-quality output make it worth your consideration.

If your text printing needs are intensive enough to require a line printer emulator, choose the OTC Euroline 600. At $6,995, it's not cheap, nor is it a good choice for quality printing. It has a maximum resolution of 240 by 216 dpi and includes only a line printer font. But for fast draft text printing, you can't make a better choice than this durably built system. This triple-headed unit bested its three line-printer-emulator competitors in this roundup, handling 477 lines per minute in narrow-carriage draft mode and 500 lpm in wide-carriage draft mode.

OF SPECIAL NOTE

A few other products in this review warrant special note. The $469 3.2-pound Citizen PN48 thermal fusion printer, an Editors' Choice in last year's annual printer issue and in the August 1992 issue on portable printers, is still the best buy for sheer portability. But the much heavier (10-pound), much costlier ($1,395) Axonix MilWrite portable printer should be on the list of anyone who needs rugged printing in difficult environments. Rated to withstand everything from sandstorms to high-speed winds, this sturdily built unit defines durability.

No 9-pin printers stand out for general-purpose work, but with scores of 226 cps in draft mode, the 9-pin wide-carriage Okidata Pacemark 3410 is worth consideration for high-production work. It doesn't offer the print quality of the $1,995 DL5800 or the speed of the $3,295 AP 1371, but at $1,999, it provides a good combination of price and performance for draft-quality applications.

Finally, the Epson ActionPrinter 3250 delivers excellent output and two internal scalable fonts, though it does fall short on speed. This printer's price is right—about $230 on the street—and it is well suited for anyone who prints light-duty jobs where text output quality matters.

in draft mode and 30 cps in quality mode); these speeds are not unacceptable in a portable design, however.

On graphics printing, the Mannesmann Tally MT150/24 and MT151/24 tied for the fastest speed at 2.6 gppm. The portable Tandy DMP 310 Slimline Printer again took last place, with its score of 0.3 gppm.

The four line printers are simply too fast to compete with the other dot matrix printers. Since the usual province for this group is wide-carriage draft text, we report the results of this test for this group only. Of the four units, the three-headed Euroline 600 led when printing in wide-carriage draft mode, with 500 lpm. The Genicom 4440 XT took second-place in that arena by putting through 425 lpm.

IN THIS REVIEW

This year, 35 new printers from 19 vendors met our review criteria: 12 9-pin printers, 3 18-pin printers, 16 24-pin printers, and 4 line printer emulators. We don't usually review products from vendors who are OEM licensees of printers we've reviewed in the past, but because of Tandy Corp.'s wide customer base and distribution network, we made an exception for the Tandy DMP 310 Slimline Printer. (This unit is built to the specs of the Seikosha LT 20, which we reviewed last year.)

Printers that didn't ship in time for inclusion here include the $549 Axonix ThinWrite 2000, the $399 Citizen GSX-230, the $549 IBM Portable Printer, the $2,295 Mannesmann Tally MT350 and $2,695 MT360, and the $699 Okidata ML590.

Advanced Matrix Technology's new $995 Intelliplot Personal Plotter and $1,995 Intelliplot Turbo II aren't here because they are upgrades of earlier printers that now include HPGL. Facit declined to send its new $3,799 Facit E950 for review. Because we recently reviewed the $499 Toshiba ExpressWriter 201 portable printer, we don't include it here. (You can find this review in our August 1992 issue.)

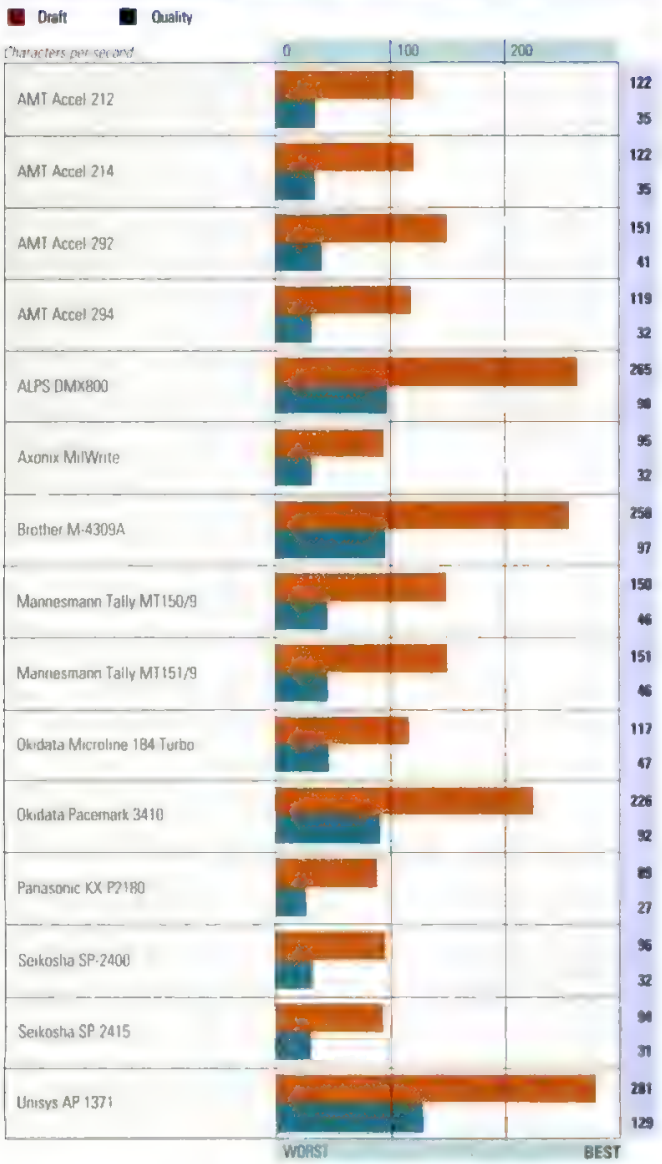
For now, the dot matrix printer market continues to offer a healthy choice of options to meet a variety of needs. The reviews you will find in the following pages will help you select the price/performance fit that is best for you.

Performance Tests: 9- and 18-Pin Dot Matrix

CONTINUES

The costly 18-pin Unisys AP 1371 outpaced all the other 9- and 18-pin entries on our Text Speed test. The 9-pin Okidata Pacemark 3410, which didn't lag far behind the 18-pin Unisys printer on our Text Speed test, raced ahead of all its competition on our Graphics Speed test.

TEXT SPEED



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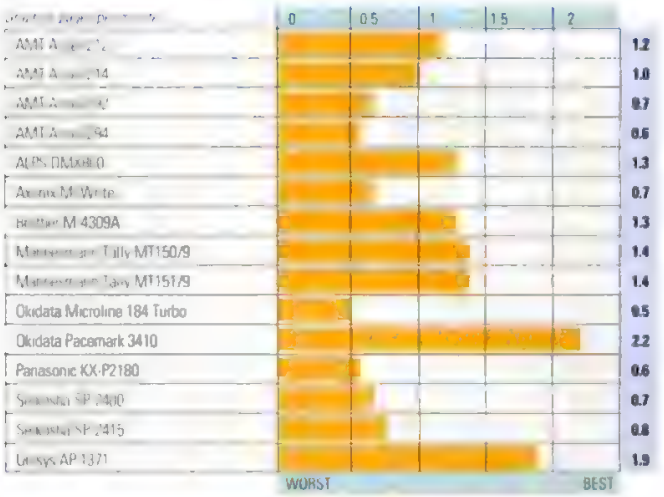
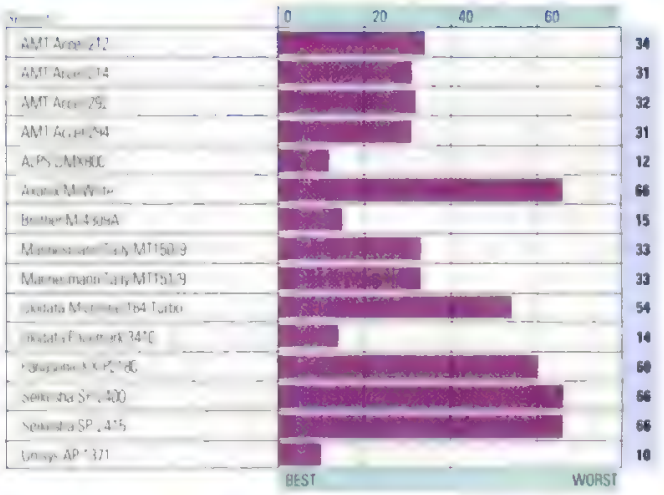
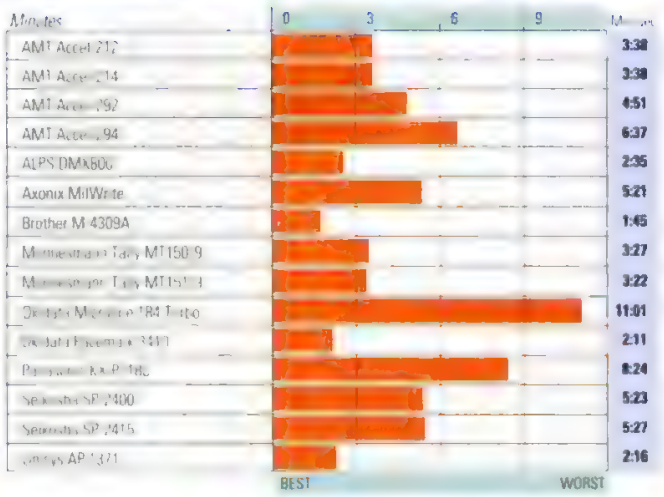


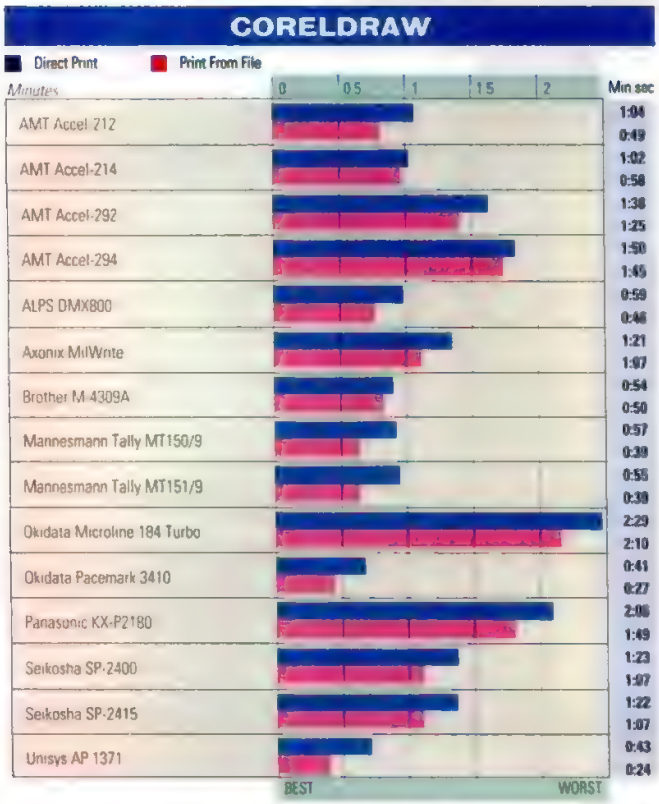
PAGE EJECT



WORD FOR WINDOWS



Performance Tests: 9- and 18-Pin Dot Matrix



ENDS

The **Text Speed** test measures the printer's speed in sending and printing one copy of a two-page business letter with 1-inch margins in 10-cpi type. We ran the test twice, once in draft mode and once in quality mode.

The **Graphics Speed** test measures the printer's speed in sending and printing two copies of a graphics image created using CorelDRAW and Microsoft Windows 3.1.

The **Page Eject** test measures the time required to eject ten blank pages. This test reflects the printer's paper-handling abilities.

The **Word for Windows** test records the time required to print a two-page business report that uses multiple fonts and type styles. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

The **CorelDRAW** test measures the time required to print a CorelDRAW graphics file. We run the test in two different ways: first as a direct print from within the application (Direct Print) and then as a print of a pregenerated file external to the application (Print from File). It uses the same graphics file as the Graphics Speed test does. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

Advanced Matrix Technology Inc.

AMT Accel-212
AMT Accel-214
AMT Accel-242
AMT Accel-244
AMT Accel-292
AMT Accel-294

BY M. DAVID STONE

In its latest foray into the desktop printer market, Advanced Matrix Technology (AMT) offers six models: two 9-pin printers (the $469 AMT Accel-212 and $529 AMT Accel-214), two dual-head 9-pin printers (the $795 AMT Accel-292 and $895 AMT Accel-294), and two 24-pin printers (the $529 AMT Accel-242 and $595 AMT Accel-244). The 9-pin printers are basic units, the 24-pin units deliver good text output, and the dual-head models offer speed. All six printers rate somewhat above-average, though they are not without problems.

Setup is simple for all six: Plug in the power cord and cable, then snap in the ribbon cartridge and thread it across the printhead. Apart from accommodating different paper widths (a maximum of 12 inches for the narrow-carriage units and 17 inches for the wide-carriage printers), they offer the same paper-handling features, including a rear U-shaped paper path and a straight bottom-feed path. The push-tractor position handles card stock and four-part forms without problems. You can also install the tractors as pull tractors for bottom-feeding.

With the tractors in the push position, you can park the tractor-feed paper and feed single sheets and envelopes through the single-sheet guide. By year's end, AMT plans to offer 200-sheet single-bin sheet feeders ($229 and $259 for the narrow- and wide-carriage printers, respectively), dual-bin versions ($349 and $399, respectively), and roll-paper holders ($69 and $89, respectively). It will also offer a $95 bar code emulation that will support Postnet and standard bar codes. All units come with 8K of RAM, expandable up to 512K for $295.

All six offer an unusual control panel, with a 16-character LCD, six buttons, the ability to program up to three user profiles, and a feature called Select-Dial: a faceup wheel with a fingertip-size depression that makes it easy to turn.

The Select-Dial serves multiple functions. When the printer is off-line, turning the wheel moves the paper forward or backward. When the printer is in setup mode, turning the wheel moves through the setup options that show on the LCD panel. To change a setting, you dial up the option and then cycle through the choices by holding down one of the buttons while you turn the wheel. This dial-up approach lets you whiz through the 40 or so options far faster than if you had to punch buttons.

AMT ACCEL-212 AND AMT ACCEL-214

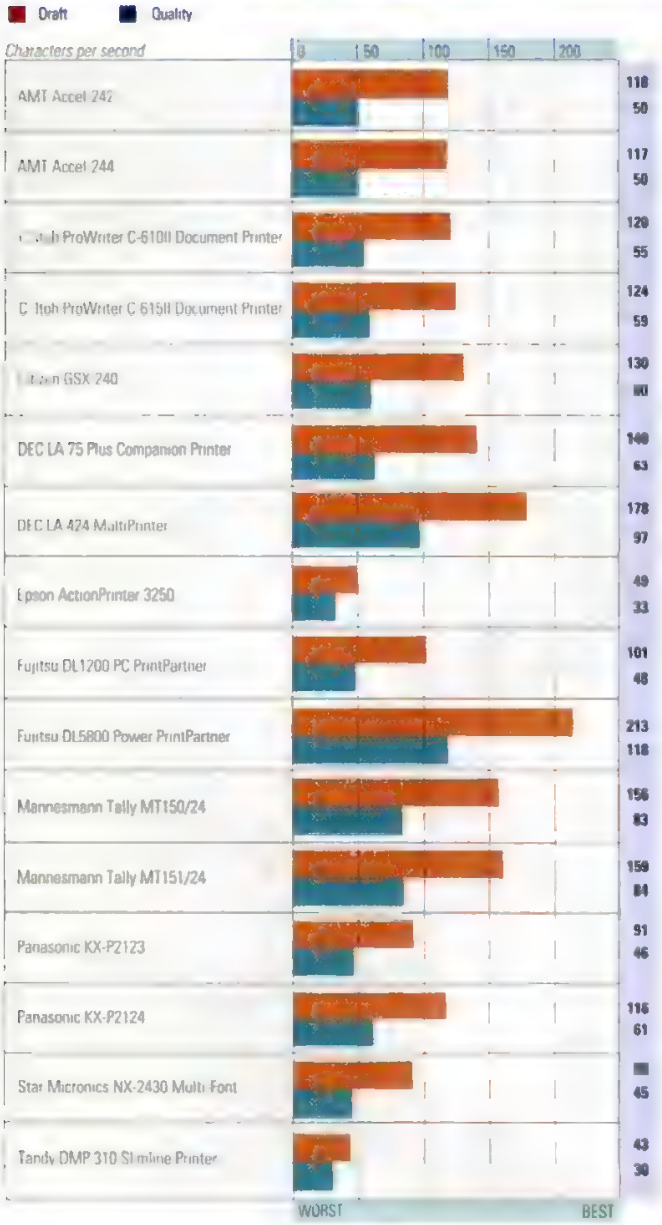
Both the narrow-carriage Accel-212 (with a street price near $350) and the wide-carriage Accel-214 (with a street price near $400) print text acceptably and graphics surprisingly well. They print 240 by 216 dots per inch and handled shaded areas and solid blacks well.

Both offer Epson FX and Lexmark

CONTINUES

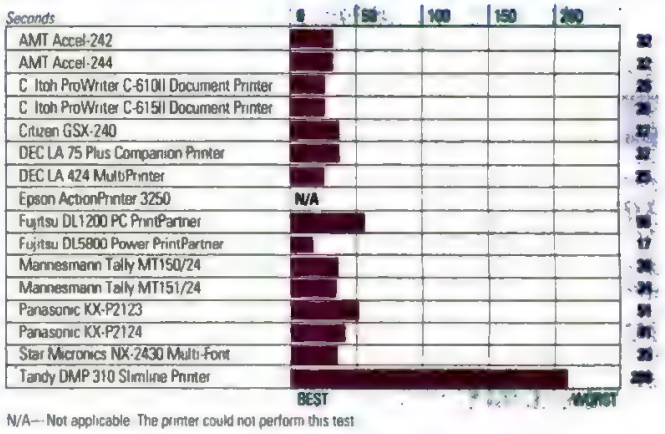
Among the 24-pin entries, the high-end Fujitsu DL5800 Power PrintPartner was the fastest text printer. No other 24-pin printer, however, could approach the raw speed of the Mannesmann Tally systems on our Graphics Speed test.

TEXT SPEED



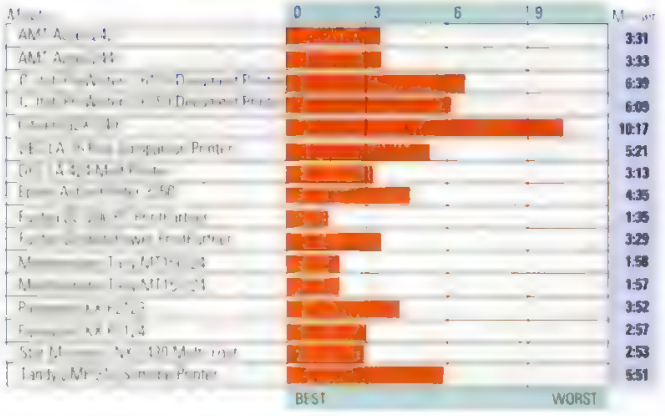
GRAPHIC SPEED

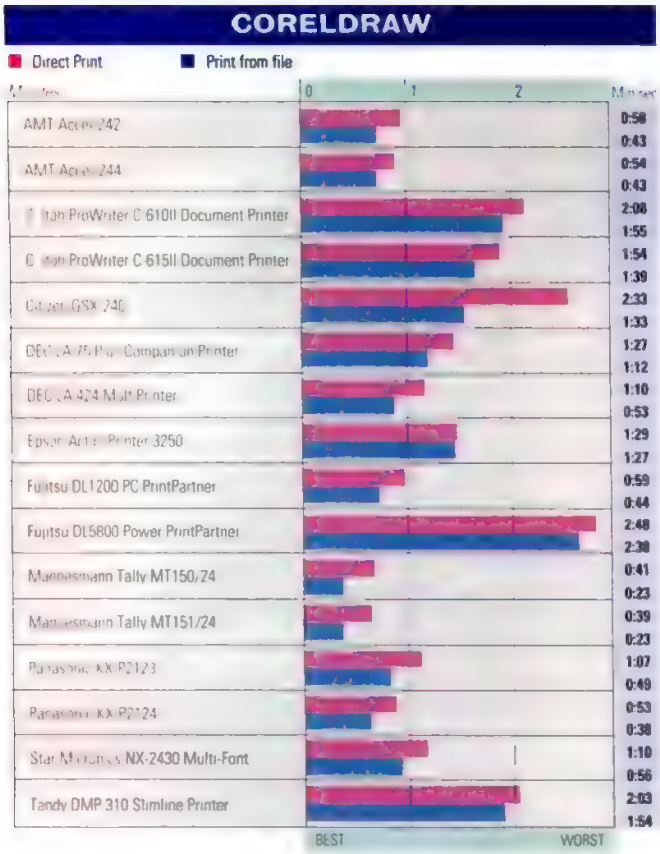
PAGE EJECT



N/A—Not applicable. The printer could not perform this test

WORD FOR WINDOWS





ENDS

The **Text Speed** test measures the printer's speed in sending and printing one copy of a two-page business letter with 1-inch margins in 10-cpi type. We ran the test twice, once in draft mode and once in quality mode.

The **Graphics Speed** test measures the printer's speed in sending and printing two copies of a graphics image created using CorelDRAW and Microsoft Windows 3.1.

The **Page Eject** test measures the time required to eject ten blank pages. This test reflects the printer's paper-handling abilities.

The **Word for Windows** test records the time required to print a two-page business report that uses multiple fonts and type styles. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

The **CorelDRAW** test measures the time required to print a CorelDRAW graphics file. We run the test in two different ways: first as a direct print from within the application (Direct Print) and then as a print of a pregenerated file external to the application (Print from File). It uses the same graphics file as the Graphics Speed test does. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

238*x* emulations (the Lexmark 238*x*-series printers are slight variations of the 9-pin IBM Proprinter) and come with three fonts, including a line printer font.

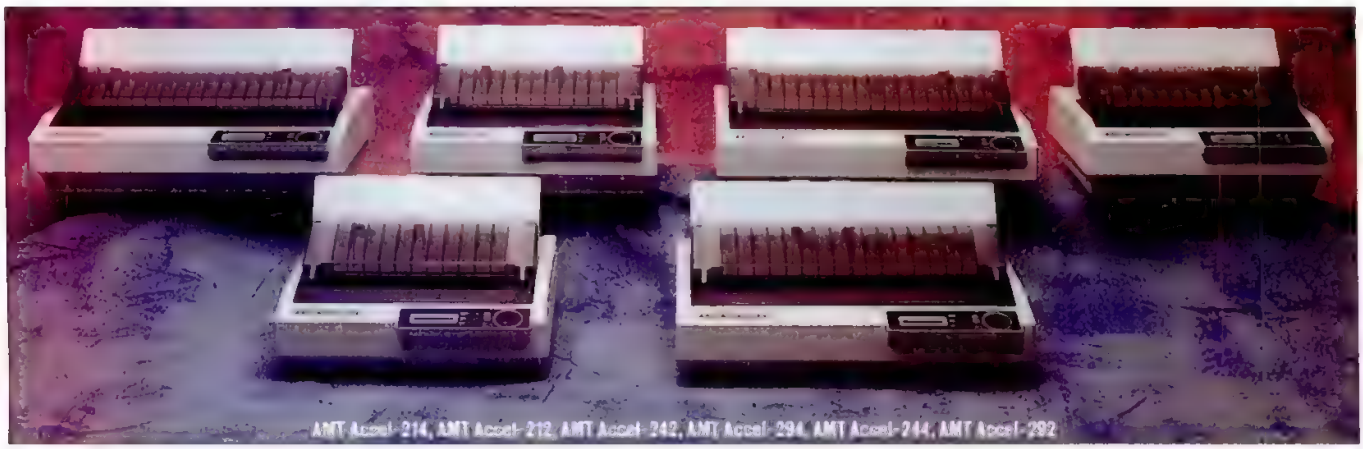
On our Text Speed test, the Accel-212 and the Accel-214 each turned in decent scores of 35 characters per second in quality mode (IBM emulation).

AMT ACCEL-242 AND AMT ACCEL-244

If you need high-quality text output, the 24-pin narrow-carriage Accel-242 (with a street price near $400) and the wide-carriage Accel-244 (with a street price near $450) will provide it.

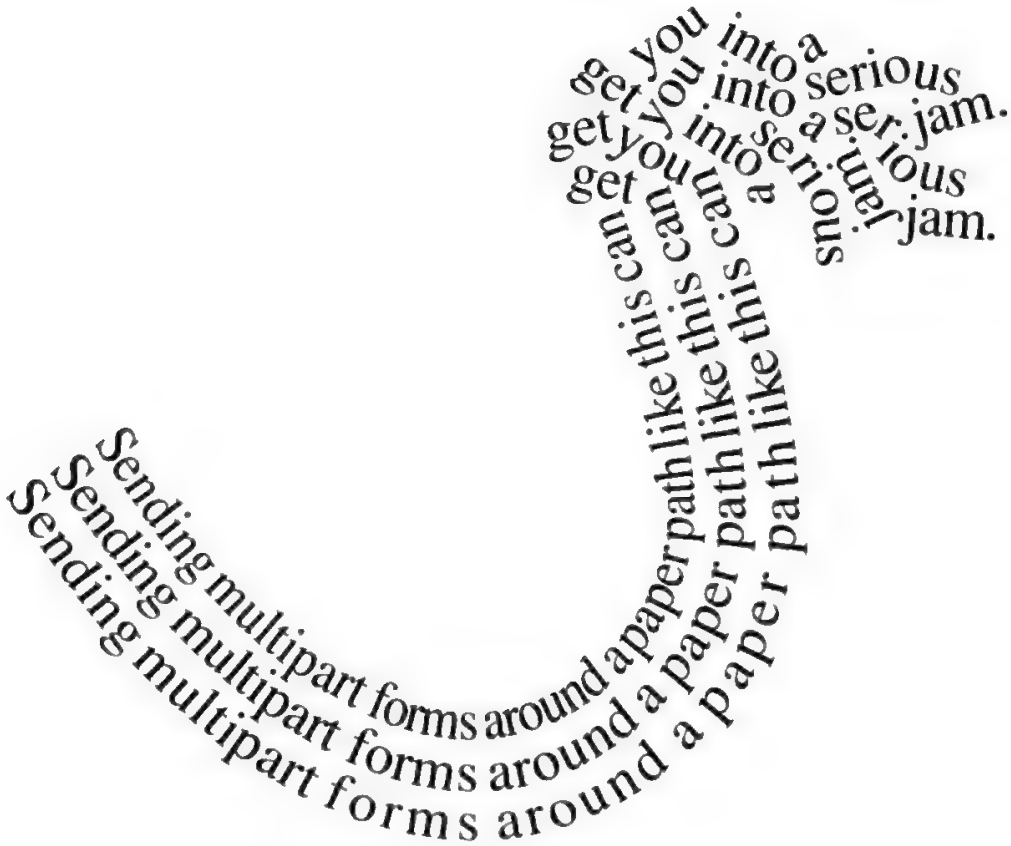
They both print 360 by 360 dots per inch and offer Lexmark 239*x* (variations of the 24-pin IBM Proprinter) and Epson emulations, eight fonts, and a high-speed draft mode. Both printers scored 50 cps on our Text Speed test in quality mode. Draft text is dark, with nearly solid characters. Letter-quality output is close to true letter quality.

Their graphics printing is less than ideal, though output from both units retained shading and detail. In both emulations, these two models printed vertical lines with short segments slightly offset from each other and left some horizontal white gaps. According to AMT, all six printers have a hidden feature for adjusting the vertical alignment, though you need to call the company's technical support number if you want to find out how to use it.



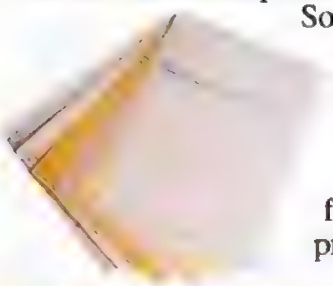
AMT Accel-214, AMT Accel-212, AMT Accel-242, AMT Accel-294, AMT Accel-244, AMT Accel-292

Photographs by Thom O'Connor



IBM PPS II Dot Matrix Printers.

A conventional paper path can turn multipart forms into multipart horror stories. Jams. Downtime. Expensive waste.



So we created the simple, virtually straight paper path of the IBM Personal Printer Series II dot matrix printers.

In tests using six-part forms on wide-carriage printers—the toughest possible conditions—the prestigious National Software Testing Laboratories found the 9-wire PPS II to be *jam free*. No other machine tested even came close.

Along with its no-U-turn design, the PPS II has front, bottom and rear paper feeds, simple front-panel controls, and tractors that switch from pull to push in seconds, for rip-and-run efficiency. All for

THE STRAIGHT-PAPER-PATH,

So we designed the straight, simple paper path of the IBM PPS II.
So we designed the straight, simple paper path of the IBM PPS II.
So we designed the straight, simple paper path of the IBM PPS II.

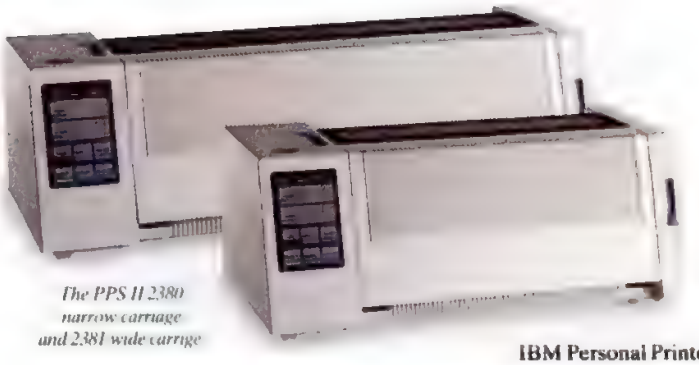
about the same price as the competition.

The IBM PPS II is designed by Lexmark, developer, manufacturer and distributor of IBM personal printers, typewriters, keyboards and related supplies.

For more on the IBM PPS II, call 1 800 358-5835 (in Canada, 1 800 663-7662) for your nearest dealer.

Tell him you need a printer you can count on when the going gets thick.

CIRCLE 098 ON READER SERVICE CARD



The PPS II 2380 narrow carriage and 2381 wide carriage

IBM Personal Printers by
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FLAT-OUT-RELIABLE IBM PPS II

Performance Tests: Line Printers

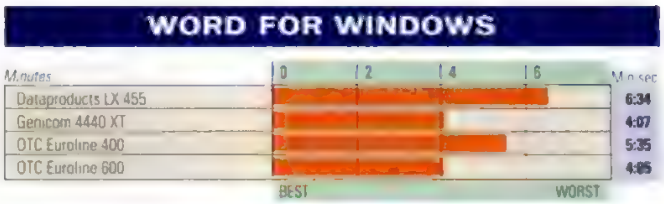
The OTC Euroline 600, the only line printer reviewed here that offers three printheads, was the best performer on our Text Speed test. The Dataproducts LX 455 took the lead for graphics printing, but it was the only printer whose draft speed on our wide-carriage Text Speed test was significantly slower than its draft speed on our narrow-carriage test.

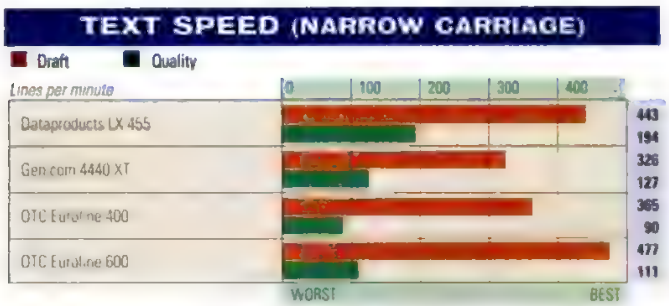
The **Text Speed** test measures the time it takes to send and print one copy of a two-page business letter with 1-inch margins in 10-cpi type. The test is performed once in draft mode (for both narrow and wide-carriage settings) and once in quality mode (for narrow-carriage settings only).

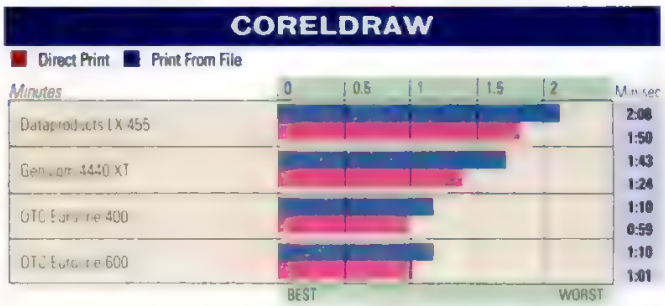
The **Graphics Speed** test measures the time it takes to send and print two copies of a graphics image created by using CorelDRAW and Microsoft Windows 3.1.

The **Word for Windows** test records the time required to print a two-page business report that uses multiple fonts and type styles. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.

The **CorelDRAW Windows** test measures the time required to print a CorelDRAW graphics file. The test consists of two procedures: a direct print from within the application (LPT1) and a print of a pregenerated file external to the application (file). It uses the same graphics file as the Graphics Speed test does. We conducted this test with the Microsoft Windows driver recommended by each printer manufacturer.







AMT ACCEL-292 AND AMT ACCEL-294

The narrow-carriage Accel-292 (with a street price near $600) and wide-carriage Accel-294 (with a street price near $675) are dual-head versions of the Accel-212 and Accel-214, with 9-pin printheads and the same emulations, fonts, and print quality. These dual-head printers are worth considering if your main concern is text speed. As you would expect from a wide-carriage printer, the Accel-294 will not provide any extra text speed for 8.5-inch-wide paper.

On the Text Speed test in quality mode, the Accel-292 placed above its 9-pin brethren by scoring 41 cps. But the Accel-294 scored 32 cps, slower than the single-head versions. On tests using wide-carriage paper, however, the dual-head Accel-294 was almost 40 percent faster than the single-head Accel-214. On the Graphics Speed test (run on standard-size paper), the dual-head units both lost to the single-head printers, however.

Both dual-head printers suffered from a few problems during testing. When faced with a line containing italic, compressed, and subscripted text, they printed all three words on top of each other. AMT says it has fixed this problem since we encountered it.

Another problem turned up only with the Accel-294. When the left printhead was handling all or most of the printing, the right printhead left a trail on the paper—even with the printhead adjusted to the widest gap. But since the trail only showed up when the right printhead wasn't printing, this is not an issue if you are printing the entire width of wide-carriage paper.

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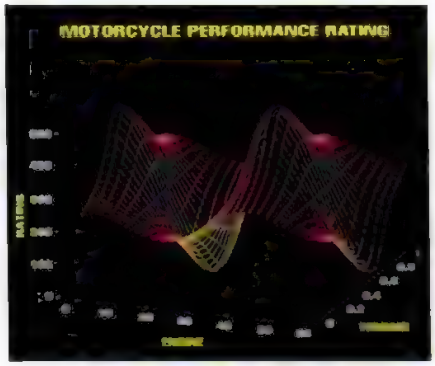

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CIRCLE 365 ON READER SERVICE CARD

Once Again, CA-SuperCalc's Numbers Crunched 'Em.

VARBUSINESS
Spreadsheet Report Card 1992

	Average Score	Access Tech.	Computer Assoc's	Lotus	Microsoft
PRODUCT FEATURES					
Ease of use	7.02	6.70	7.00	6.81	7.52
Memory requirement	6.40	6.82	6.89	5.71	6.18
Ease of programming	6.48	6.33	6.58	6.32	6.80
Ability to manipulate data	7.35	7.80	7.29	7.00	7.52
Sorting capabilities	6.90	7.67	6.94	6.58	6.73
Provisions for software security	5.85	5.87	5.87	5.32	5.75
Report writing capabilities	6.14	5.57	6.28	5.89	6.82
Ease of use of interface	6.82	6.75	6.70	6.18	7.83
Software integration capabilities	6.94	6.94	6.82	6.32	7.31
Ease of data retrieval	7.41	7.98	7.52	7.10	7.44
Satisfaction with product profitability	6.21	6.47	6.44	6.05	5.90
Overall quality of product	7.48	7.28	7.72	7.38	7.75
Product features average	6.73	6.90	6.90	6.37	6.94
SUPPORT FEATURES					
Provision for customer support	5.68	5.06	6.97	5.47	6.02
Charges for training time	5.17	4.38	5.95	5.05	5.29
Provision for technical support	5.78	5.20	6.60	5.40	5.85
Provision for marketing support	5.65	5.00	6.40	5.43	5.75
Documentation & product information	6.85	6.25	7.27	6.77	7.13
Frequency of updates & revisions	5.99	6.06	6.95	5.84	6.10
Support features average	5.88	5.33	6.52	5.66	6.02
OVERALL AVERAGE	6.45	6.31	6.71	6.13	6.83

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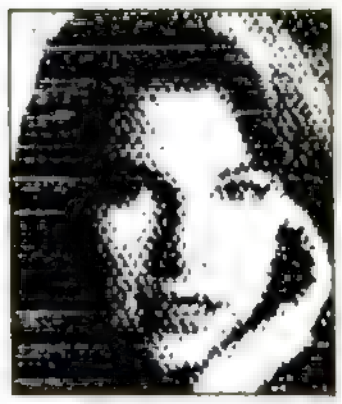
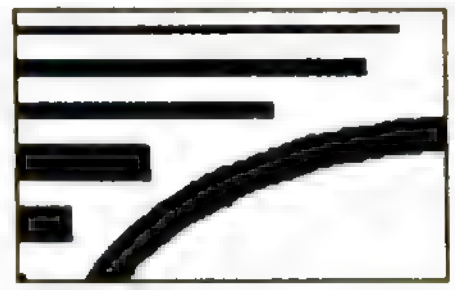
AMT Accel-212 — $469

9-pin narrow-carriage dot matrix printer



Roman
Sans Serif



Draft Text Speed: 122 cps
Quality Text Speed: 35 cps
Graphics Speed: 1.2 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 38 sec.
CorelDRAW (Direct): 1 min. 4 sec.
CorelDRAW (File): 0 min. 49 sec.

AMT Accel-214 — $529

9-pin wide-carriage dot matrix printer

Roman
Sans Serif

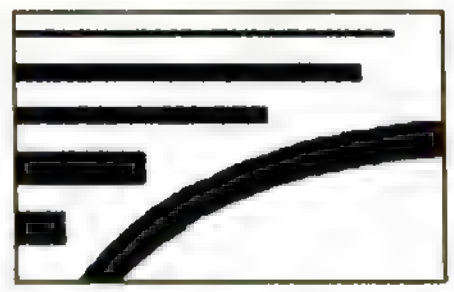
Draft Text Speed: 122 cps
Quality Text Speed: 35 cps
Graphics Speed: 1.0 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 38 sec.
CorelDRAW (Direct): 1 min. 2 sec.
CorelDRAW (File): 0 min. 58 sec.

AMT Accel-242 — $529

24-pin narrow-carriage dot matrix printer

Roman
Courier
OCR-B
ORATOR



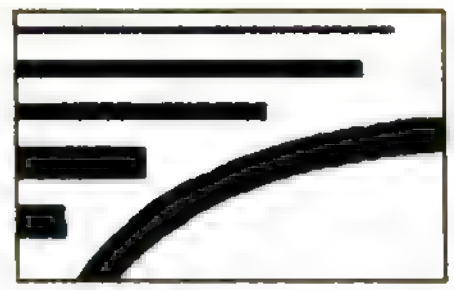
Draft Text Speed: 118 cps
Quality Text Speed: 50 cps
Graphics Speed: 1.8 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 31 sec.
CorelDRAW (Direct): 0 min. 58 sec.
CorelDRAW (File): 0 min. 43 sec.

AMT Accel-244 — $595

24-pin wide-carriage dot matrix printer

Roman
Sans Serif
Courier
Script



Draft Text Speed: 117 cps
Quality Text Speed: 50 cps
Graphics Speed: 1.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 33 sec.
CorelDRAW (Direct): 0 min. 54 sec.
CorelDRAW (File): 0 min. 43 sec.

AMT Accel-292 — $795

Dual-head 9-pin narrow-carriage monochrome dot matrix printer

Roman
Sans Serif

Draft Text Speed: 151 cps
Quality Text Speed: 41 cps
Graphics Speed: 0.7 gppm

WINDOWS APPLICATIONS
Word for Windows: 4 min. 51 sec.
CorelDRAW (Direct): 1 min. 38 sec.
CorelDRAW (File): 1 min. 25 sec.

AMT Accel-294 — $895

Dual-head 9-pin wide-carriage dot matrix printer

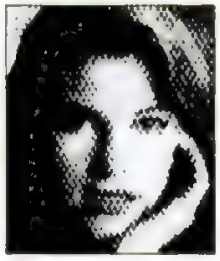
Draft Text Speed: 119 cps
Quality Text Speed: 32 cps
Graphics Speed: 0.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 8 min. 37 sec.
CorelDRAW (Direct): 1 min. 50 sec.
CorelDRAW (File): 1 min. 45 sec.

Roman
Sans Serif

ALPS DMX800 — $2,195

18-pin wide-carriage dot matrix printer



Draft Text Speed: 265 cps
Quality Text Speed: 98 cps
Graphics Speed: 1.3 gppm

WINDOWS APPLICATIONS:
Word for Windows: 2 min. 35 sec.
CorelDRAW (Direct): 0 min. 59 sec.
CorelDRAW (File): 0 min. 46 sec.

Courier
Gothic
Quadro
Roman

Axonix MilWrite — $1,395

9-pin narrow-carriage dot matrix printer

Draft Text Speed: 95 cps
Quality Text Speed: 32 cps
Graphics Speed: 0.7 gppm

WINDOWS APPLICATIONS:
Word for Windows: 5 min. 21 sec.
CorelDRAW (Direct): 1 min. 21 sec.
CorelDRAW (File): 1 min. 7 sec.

Sans Serif
Courier
Prestige
Gothic

Brother M-4309A — $2,195

18-pin wide-carriage dot matrix printer

Draft Text Speed: 258 cps
Quality Text Speed: 97 cps
Graphics Speed: 1.3 gppm

WINDOWS APPLICATIONS:
Word for Windows: 1 min. 45 sec.
CorelDRAW (Direct): 0 min. 54 sec.
CorelDRAW (File): 0 min. 50 sec.

Roman
Sans Serif
Prestige
Gothic

C. Itoh ProWriter C-6101I Document Printer — $799

24-pin narrow-carriage dot matrix printer

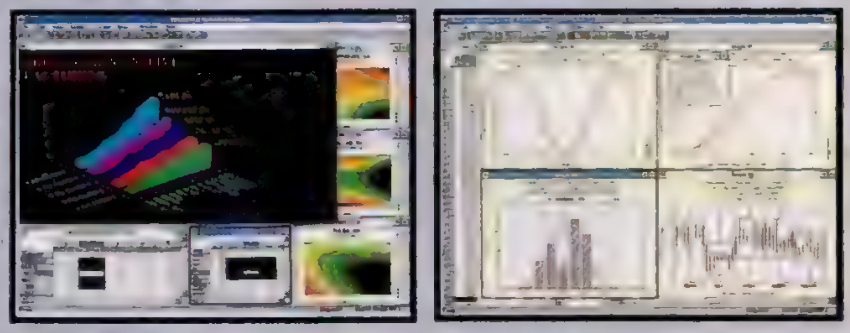
Draft Text Speed: 120 cps
Quality Text Speed: 55 cps
Graphics Speed: 0.5 gppm

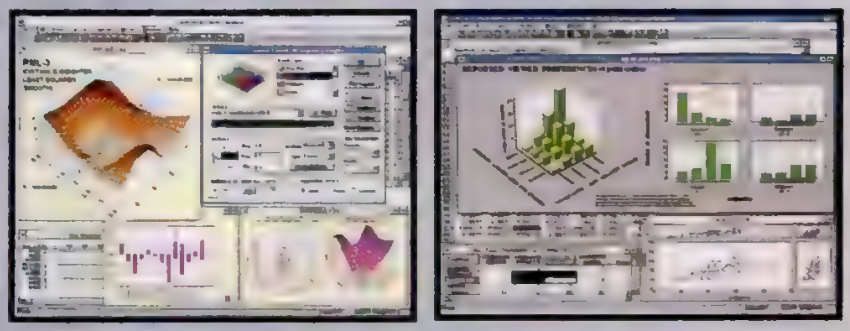
WINDOWS APPLICATIONS:
Word for Windows: 6 min. 39 sec.
CorelDRAW (Direct): 2 min. 8 sec.
CorelDRAW (File): 1 min. 55 sec.

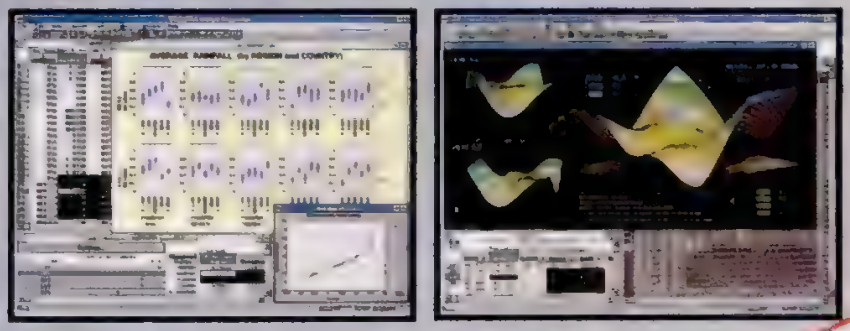
Roman
Courier
Sans Serif
Elite

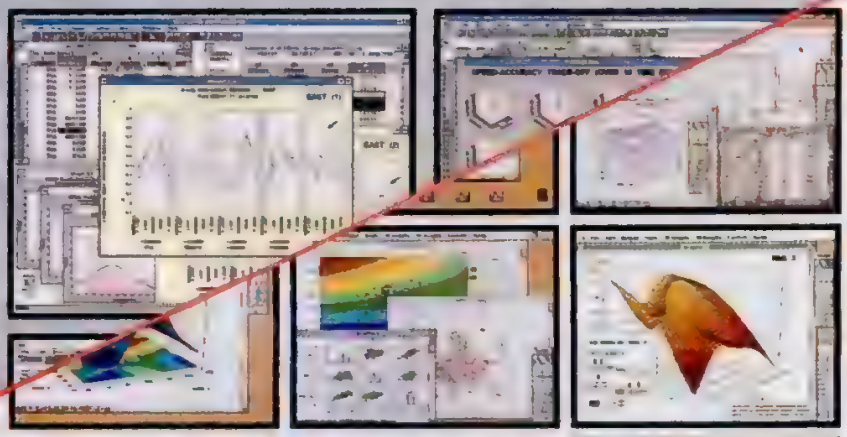
STATISTICA/w

Windows, DOS, Macintosh









STATISTICA/w™ (for Windows) Complete Statistical System with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures ■ Complete Windows 3.1 support, DDE, OLE, TT-fonts, multiple toolbars, right mouse button support ■ Unlimited numbers of data-, results-, and graph-windows ■ Inter-window integration: data, results, and graphs can be treated as objects and converted into one another in a number of ways ■ The largest selection of statistics and graphs in a single system; comprehensive implementations of: Exploratory techniques; multiway tables with banners (presentation-quality reports); nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; time series modeling; forecasting; lags analysis; quality control; process analysis; experimental design (with Taguchi); and much more ■ Manuals with comprehensive introductions to each procedure and examples ■ Hypertext-based Stats Advisor expert system ■ Extensive data management facilities (spreadsheet with long formulas, block operations, advanced Clipboard support, DDE hot links, relational merge, data verification, powerful programming language) ■ Batch command language and macros also supported, "turn-key system" options ■ All output displayed in Scrollsheets™ (dynamic, customizable, presentation-quality tables with toolbars, pop-up windows, and instant 2D, 3D and multiple graphs) ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, unlimited ANOVA designs) ■ Megafile Manager with up to 32,000 variables (8 Mb) per record ■ Unlimited size of files; extended ("quadruple") precision; unmatched speed ■ Exchanges data and graphs with other applications via DDE or an extensive selection of file import/export facilities ■ Hundreds of types of graphs, including categorized multiple 2D and 3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs ■ Facilities to custom design new graphs and add them permanently to menu ■ On-screen graph customization with advanced drawing tools, interactive stretching and resizing of complex objects, interactive embedding of graphs and artwork, special effects, icons, maps, multi-graphics management, page layout control for slides and printouts; unmatched speed of graph redraw ■ Interactive rotation, perspective and cross-sections of all 3D and 4D graphs ■ Extensive selection of tools for graphical exploration of data: fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets ■ Price **$995**.

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CIRCLE 057 ON READER SERVICE CARD FOR IBM
CIRCLE 059 ON READER SERVICE CARD FOR MAC

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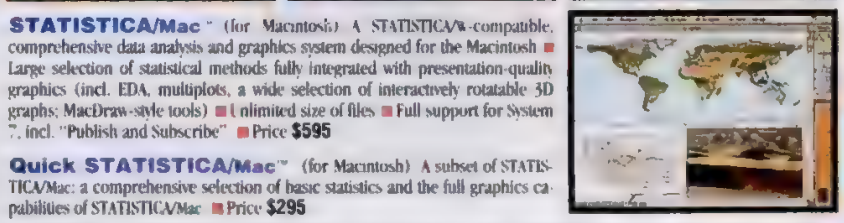

STATISTICA/Mac™ (for Macintosh) A STATISTICA/w-compatible, comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl. EDA, multiplots, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ Unlimited size of files ■ Full support for System 7, incl. "Publish and Subscribe" ■ Price **$595**

Quick STATISTICA/Mac™ (for Macintosh) A subset of STATISTICA/Mac: a comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/Mac ■ Price **$295**

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Memories.

Remember the time you borrowed the company laptop and couldn't find the files you left in the hard drive? Or the time you needed to get at some data in the hard drive when someone had the computer on the road?

Aurum's new 486 notebook computer — *with interchangeable 2.5" hard drives* — will make such unpleasant memories a thing of the past. Because now each of the notebook's users can have a 60, 80, or 130 MB hard drive of their very own. Not only is data security enhanced, but the hard drives can be connected to any of our powerful desktop systems so data is available even if the notebook isn't.

intel inside

You may be unfamiliar with the Aurum name, but you are familiar with Aurum products. Since 1980, we have designed and built literally hundreds of thousands of computers for leading companies in over 50 countries throughout the world.

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- Intel486™ SX/25 with 8KB cache
- 4 MB RAM expandable to 16 MB
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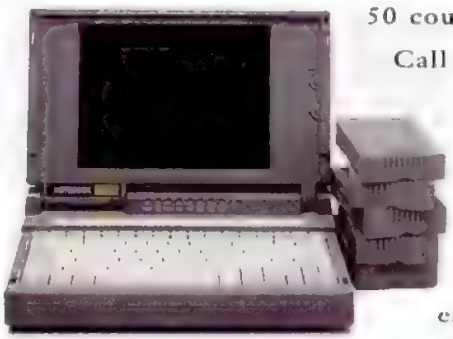
- Windows 3.1 and DOS 5.0
- Additional disk drives: 80 MB $399, 130 MB $499



Call us right now at **800-55-AURUM** and order a notebook and some hard drives that you can exchange with your friends. Because Aurum's price, performance, service and support are the finest in recent memories.

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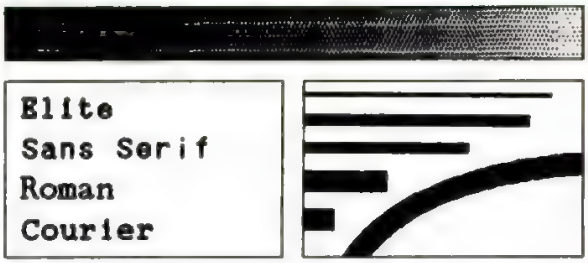
CIRCLE 099 ON READER SERVICE CARD

C. Itoh ProWriter C-615II Document Printer — $1,175

PC MAGAZINE EDITORS' CHOICE

24-pin wide-carriage dot matrix printer

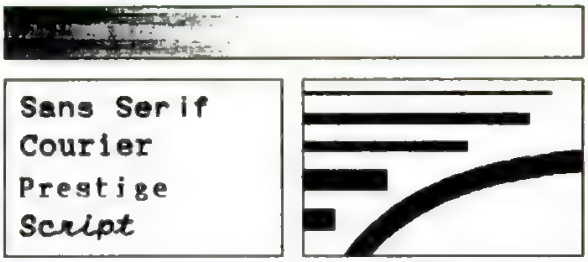


Draft Text Speed: 124 cps
Quality Text Speed: 59 cps
Graphics Speed: 0.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 6 min. 9 sec.
CorelDRAW (Direct): 1 min. 54 sec.
CorelDRAW (File): 1 min. 39 sec.

Citizen GSX-240 — $499

24-pin narrow-carriage dot matrix printer



Draft Text Speed: 130 cps
Quality Text Speed: 60 cps
Graphics Speed: 1.3 gppm

WINDOWS APPLICATIONS:
Word for Windows: 10 min. 17 sec.
CorelDRAW (Direct): 2 min. 33 sec.
CorelDRAW (File): 1 min. 33 sec.

Dataproducts LX 455 — $4,595

33-pin wide-carriage line printer emulator

Draft Text Speed: 443 lpm
Draft (wide-carriage): 350 lpm
Quality Text Speed: 194 lpm
Graphics Speed: 2.1 gppm

WINDOWS APPLICATIONS:
Word for Windows: 6 min. 34 sec.
CorelDRAW (Direct): 2 min. 8 sec.
CorelDRAW (File): 1 min. 50 sec.

DEC LA 75 Plus Companion Printer — $549

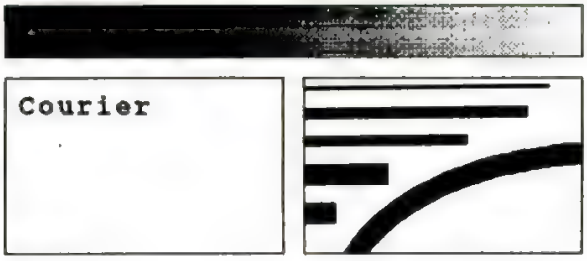
24-pin narrow-carriage dot matrix printer

Draft Text Speed: 140 cps
Quality Text Speed: 63 cps
Graphics Speed: 0.5 gppm

WINDOWS APPLICATIONS:
Word for Windows: 5 min. 21 sec.
CorelDRAW (Direct): 1 min. 27 sec.
CorelDRAW (File): 1 min. 12 sec.

DEC LA 424 MultiPrinter — $1,349

24-pin wide-carriage dot matrix printer



Draft Text Speed: 178 cps
Quality Text Speed: 97 cps
Graphics Speed: 0.8 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 13 sec.
CorelDRAW (Direct): 1 min. 10 sec.
CorelDRAW (File): 0 min. 53 sec.

Epson ActionPrinter 3250 — $299

24-pin narrow-carriage dot matrix printer

Draft Text Speed: 49 cps
Quality Text Speed: 33 cps
Graphics Speed: 0.8 gppm

WINDOWS APPLICATIONS:
Word for Windows: 4 min. 35 sec.
CorelDRAW (Direct): 1 min. 29 sec.
CorelDRAW (File): 1 min. 27 sec.

Fujitsu DL1200 PC PrintPartner — $649

24-pin wide-carriage dot matrix printer

Draft Text Speed: 181 cps
Quality Text Speed: 48 cps
Graphics Speed: 0.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 29 sec.
CorelDRAW (Direct): 2 min. 48 sec.
CorelDRAW (File): 2 min. 38 sec.

Fujitsu DL5800 Power PrintPartner — $1,995

PC MAGAZINE EDITORS' CHOICE

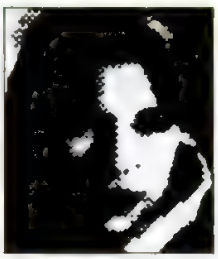
24-pin wide-carriage dot matrix printer

Draft Text Speed: 213 cps
Quality Text Speed: 118 cps
Graphics Speed: 1.7 gppm

WINDOWS APPLICATIONS:
Word for Windows: 1 min. 35 sec.
CorelDRAW (Direct): 0 min. 59 sec.
CorelDRAW (File): 0 min. 44 sec.

Genicom 4440 XT — $7,795

66-hammer wide-carriage line printer emulator



Draft Text Speed: 326 lpm
Draft (wide-carriage): 425 lpm
Quality Text Speed: 127 lpm
Graphics Speed: 0.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 4 min. 7 sec.
CorelDRAW (Direct): 1 min. 43 sec.
CorelDRAW (File): 1 min. 24 sec.

Mannesmann Tally MT150/9 — $699

9-pin narrow-carriage dot matrix printer

Draft Text Speed: 150 cps
Quality Text Speed: 46 cps
Graphics Speed: 1.4 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 27 sec.
CorelDRAW (Direct): 0 min. 55 sec.
CorelDRAW (File): 0 min. 39 sec.

WHAT DO YOU CALL PRINTERS THAT PC WEEK SAID, "FIX THE MAJOR DEFICIENCIES OF MANY EARLIER NETWORK PRINTERS"?

YOU CALL THE ONE ON THE AND THE ONE ON THE

The new COMPAQ PAGEMARQ 20 and COMPAQ PAGEMARQ 15. Two network laser printers that will immediately establish the industry benchmark. Printers for those who want nothing short of everything.

After rather extensive R&D, we realized the average network printer was doing more to raise your network's blood pressure than its productivity level.

Which led us to more extensive R&D and two breakthroughs: two network laser printers that are bristling with features designed to help everyone work in harmony.

For starters, COMPAQ-built, RISC-based controllers, along with powerful print engines, run our printers at 15 and 20 PPM. And at 20 PPM, that's 100% faster on average than HP LaserJet IIISi in PostScript applications. Which helps keep your network's output more than up to speed.

Then there's the ability to print in sizes up to 11" by 17". Which can really make your day if it's filled with everything ranging from envelopes to double-page layouts to CAD plots to spreadsheets.

The built-in motorized paper trays can hold up to 1,500 sheets, more than any other desktop printers. Allowing you to put your time to far better uses than loading paper.

To Compaq engineers it simply wasn't enough for our printers to understand both PostScript Level 2 and PCL 5. Therefore, unlike other printers, ours have an Intelligent Emulation

LEFT A BREAKTHROUGH. RIGHT A MIRACLE.

Sensing feature that continually monitors, with radar-like precision, the language that anyone is using at any moment. It will then automatically adjust to that emulation, without your lifting a finger.

Truly network-ready printers should meet all of your network needs. This is why our new COMPAQ PAGEMARQ Laser Printers provide a direct connect to both Novell and AppleTalk environments, without the need for a print server.

The printers also offer you five interfaces, so that you can simultaneously run Ethernet or Token Ring, AppleTalk, both a serial and a parallel port, and even an Internal FAX Modem. Which will lead to better communication across the entire network. Rather than the kind of language that best remains unprinted.

Completing the picture is the 800 x 400 COMPAQ High-Resolution Print Mode, created to give you exceptionally crisp text and graphics.

Both the Programmable Font Modules and internal 60-MB Hard Drive let you store PostScript fonts permanently, without having to constantly download.

Thus, what you've got amounts to far more than merely a network printer.

You have the brainchild of a company that holds the belief that utter chaos does not have to be standard operating procedure in your network.

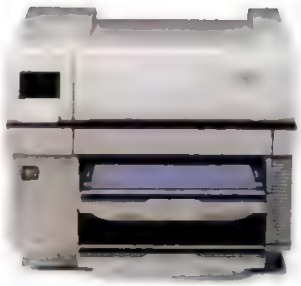
For more on COMPAQ PAGEMARQ Printers, just turn to the next page.

They print in sizes up to 11" by 17." They can handle CAD images, spreadsheets, and even double-page layouts. Multiple Twin-Trays hold up to 1,500 sheets. Impressed?

Our Intelligent Emulation Sensing feature continually monitors, then automatically adjusts to either PostScript Level 2 or PCL 5 depending upon which you're using. You needn't lift a finger.

COMPAQ

THOSE WERE THE BROADSTROKES. NOW HERE'S THE FINE PRINT.



COMPAQ PAGEMARQ 20: *20 PPM ◆ 20-MHz AMD 29000 RISC w/128-K cache ◆ 4MB RAM standard, expandable to 20MB ◆ 1,500-sheet (standard)*

COMPAQ PAGEMARQ 15: *15 PPM ◆ 16-MHz AMD 29000 RISC ◆ 4MB RAM standard, expandable to 18MB ◆ 750-sheet (standard), 1,000-sheet max w/ optional second TwinTray*

BOTH MODELS: *Up to 800 x 400dpi (COMPAQ High-Resolution Mode) ◆ PostScript Level 2 and PCL 5 w/Intelligent Emulation Sensing ◆ One slot/port each for AppleTalk, Network Interface Cards, Internal FAX Modem, Serial and Parallel Port ◆ Available Options: Internal 60-MB Hard Drive, 1- and 2-MB Programmable Font Modules ◆ Consumables: One-piece cartridge w/12,000-page yield*

At Compaq, we realize even the most advanced network printers in the world aren't worth the toner in their cartridge kits if you can't get the service or the parts that you need whenever you need them.

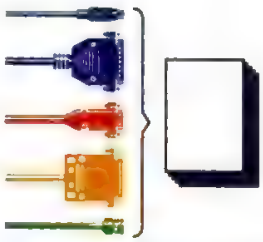
Thus we've designed CompaqCare. This is our comprehensive service and support program, which includes our free one-year, on-site* limited warranty.

It will also provide you with, among other things, repair of your printer by the second business day, anywhere in the U.S.

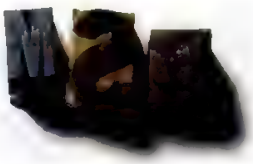
Whenever you need consumables, you can buy them at all participating office supply stores, at our more than 3,000 Authorized COMPAQ Reseller locations, or right from us.

For any questions, or to learn more about our new program for recycling consumables, phone our hotline at 1-800-345-1518 in the U.S.; in Canada, call 1-800-263-5868.

You'll find dedicated printer specialists eager to convince you that the path to greater network productivity begins not only within yourself, but along the paper path that is inside your COMPAQ PAGEMARQ Laser Printer.



Five interfaces, with a direct connect to Novell and AppleTalk, let you simultaneously run Token Ring or Ethernet, AppleTalk, a serial and parallel port, plus an Internal FAX Modem.



Store PostScript fonts forever. Expand your font library. And eliminate constant downloading with Programmable Font Modules or the internal 60-MB Hard Drive.

With our printers' optional Internal FAX Modem, you can send and receive presentation-quality documents, in sizes up to 11" by 17". Right from your desktop.

COMPAQ

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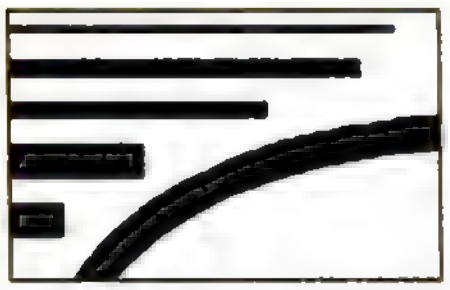
CIRCLE 137 ON READER SERVICE CARD

Mannesmann Tally MT150/24 — $899

24-pin narrow-carriage dot matrix printer

Roman
Sans Serif
Courier
Prestige



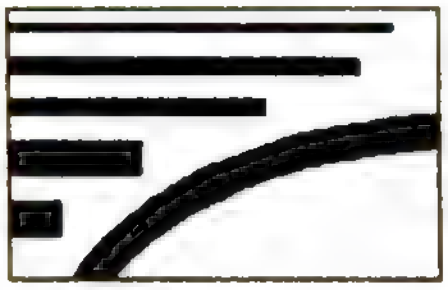
Draft Text Speed: 156 cps
Quality Text Speed: 83 cps
Graphics Speed: 2.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 1 min. 58 sec.
CorelDRAW (Direct): 0 min. 41 sec.
CorelDRAW (File): 0 min. 23 sec.

Mannesmann Tally MT151/9 — $749

9-pin wide-carriage dot matrix printer

Quadrato
Courier



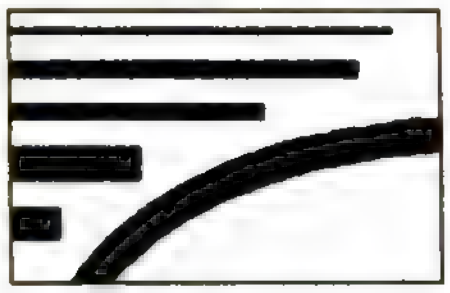
Draft Text Speed: 151 cps
Quality Text Speed: 46 cps
Graphics Speed: 1.4 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 22 sec.
CorelDRAW (Direct): 0 min. 57 sec.
CorelDRAW (File): 0 min. 39 sec.

Mannesmann Tally MT151/24 — $999

24-pin wide-carriage dot matrix printer

Courier
Sans Serif
Roman
Prestige



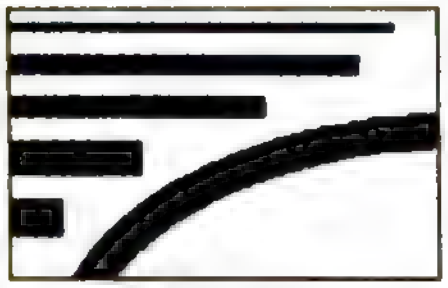
Draft Text Speed: 159 cps
Quality Text Speed: 84 cps
Graphics Speed: 2.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 1 min. 57 sec.
CorelDRAW (Direct): 0 min. 39 sec.
CorelDRAW (File): 0 min. 23 sec.

Okidata Microline 184 Turbo — $359

9-pin narrow-carriage dot matrix printer

Line Printer



Draft Text Speed: 117 cps
Quality Text Speed: 47 cps
Graphics Speed: 0.5 gppm

WINDOWS APPLICATIONS:
Word for Windows: 11 min. 1 sec.
CorelDRAW (Direct): 2 min. 29 sec.
CorelDRAW (File): 2 min. 10 sec.

Okidata Pacemark 3410 — $1,999

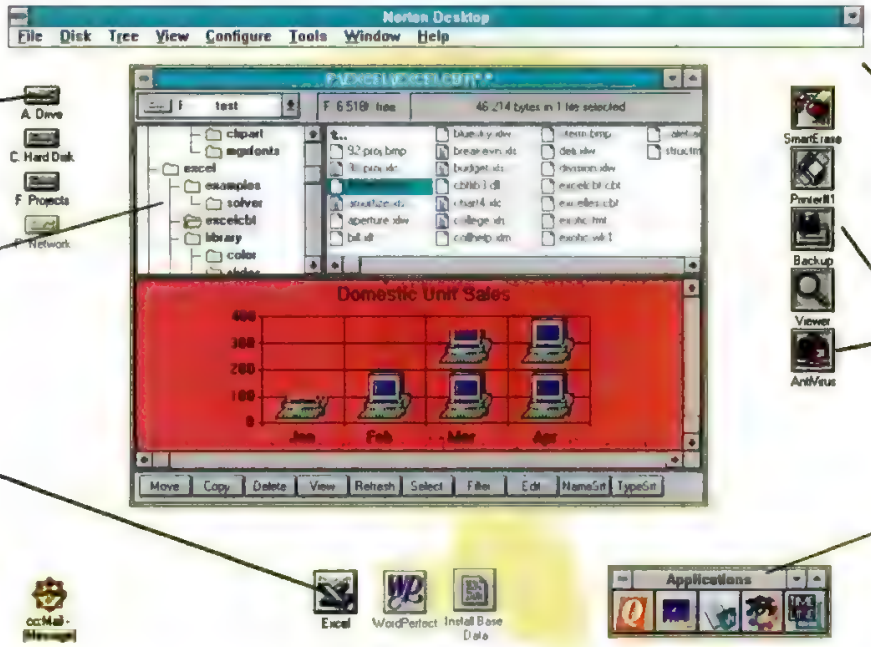
9-pin wide-carriage dot matrix printer

Courier
Gothic

Draft Text Speed: 226 cps
Quality Text Speed: 92 cps
Graphics Speed: 2.2 gppm

WINDOWS APPLICATIONS:
Word for Windows: 2 min. 11 sec.
CorelDRAW (Direct): 0 min. 41 sec.
CorelDRAW (File): 0 min. 27 sec.

NORTON DESKTOP FOR WINDOWS SAVES TIME, MONEY, ENERGY, AND DATA.



With Norton Desktop for Windows, your drive icons sit right on the desktop, so you get direct access to your files.

Click on a drive icon for easy file management. The drive window includes a tree pane, file pane, and a customizable button bar with a view option.

For total convenience, applications or files can be dragged onto the desktop for easy access. Open files effortlessly with a quick mouse click or, by dragging the file to the application.

The Norton Desktop is a completely integrated environment. You can drag-and-drop files from the drive window to a tool, drive icon, application, or onto the desktop itself.

All the utilities you need to backup, protect, and repair your data sit right on your desktop. You can drag files or drive icons directly to the tool you need.

Keep your favorite applications in a handy customizable toolbox. Launch the application easily with just a click of the mouse.

That's a package full of savings. Norton Desktop for Windows 2.0 enhances Windows in all the important ways. It helps you work faster, smarter, and with better results.

Saves Time.

Something you don't have a lot of. We've improved file management, placing drive icons right on the desktop, so you get immediate access to all your files and applications. Speed search, button bar, viewer, customizable fonts, and collapsible tree structure are all designed to save you time. Full drag-and-drop allows you to drag applications and files out of the drive window to anywhere on the desktop so you have instant access to them.

Saves Money.

We all know time is money. And because Norton Desktop looks so much like Windows, you won't have to waste time learning how to use it. You get most everything you need to run your PC in one comprehensive package — a great, money-saving value.

> "Norton Desktop for Windows 2.0 is still one of the best productivity tools you can buy."
> —*PC Computing*, 5/92

Saves Energy.

Because Norton Desktop can be easily customized, you invest your energy in your work, not in trying to figure out how to get it done. Customizable auto-load frees you from reloading applications that you use daily. And, SuperFind™ allows you to locate "lost" files, across networks or in the background.

Saves Data.

Lost or corrupted data can cost you time, money, and energy. The selection of utilities in Norton Desktop helps you maintain your data. Virus protection and repair, automatic backup, and data recovery can be easily accessed from the desktop; or, scheduled to run unattended, or in the background. Plus, they support all major networks. Norton Desktop for Windows 2.0 is just $179.00 (S.R.P.) at your dealer. Or, call **1-800-554-4403** for an instant FAX Data Sheet (enter 450).** The sooner you get it the sooner you'll save.

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CIRCLE 350 ON READER SERVICE CARD

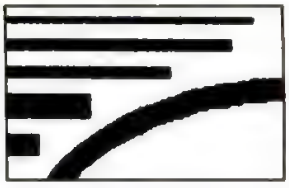
OTC Euroline 400 — $5,495

Dual-printhead (21 wires each) wide-carriage line printer emulator

Draft Text Speed: 365 lpm
Draft (wide-carriage): 363 lpm
Quality Text Speed: 90 lpm
Graphics Speed: 1.0 gppm

WINDOWS APPLICATIONS:
Word for Windows: 5 min. 35 sec.
CorelDRAW (Direct): 1 min. 10 sec.
CorelDRAW (File): 0 min. 59 sec.

Line Printer
OCR-A
OCR-B



OTC Euroline 600 — $6,995

PC MAGAZINE EDITORS' CHOICE

Triple-printhead (21 wires each) wide-carriage line printer emulator

Draft Text Speed: 477 lpm
Draft (wide-carriage): 500 lpm
Quality Text Speed: 111 lpm
Graphics Speed: 0.8 gppm

WINDOWS APPLICATIONS:
Word for Windows: 4 min. 05 sec.
CorelDRAW (Direct): 1 min. 10 sec.
CorelDRAW (File): 1 min. 1 sec.

Line Printer
OCR-A
OCR-B

Panasonic KX-P2123 — $419.95

24-pin narrow-carriage dot matrix printer

Draft Text Speed: 91 cps
Quality Text Speed: 46 cps
Graphics Speed: 0.7 gppm

WINDOWS APPLICATIONS:
Word for Windows: 3 min. 52 sec.
CorelDRAW (Direct): 1 min. 7 sec.
CorelDRAW (File): 0 min. 49 sec.

Courier
Prestige
Sans serif
Roman

Panasonic KX-P2124 — $549.95

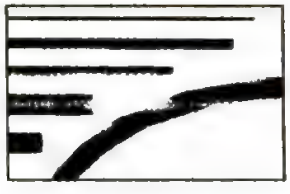
PC MAGAZINE EDITORS' CHOICE

24-pin narrow-carriage dot matrix printer

Draft Text Speed: 116 cps
Quality Text Speed: 61 cps
Graphics Speed: 1.3 gppm

WINDOWS APPLICATIONS:
Word for Windows: 2 min. 57 sec.
CorelDRAW (Direct): 0 min. 53 sec.
CorelDRAW (File): 0 min. 38 sec.

Courier
Prestige
Sans serif
Roman



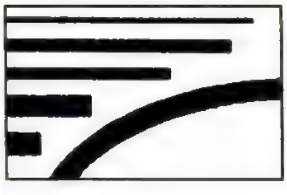
Panasonic KX-P2180 — $299.95

9-pin narrow dot matrix printer

Draft Text Speed: 89 cps
Quality Text Speed: 27 cps
Graphics Speed: 0.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 8 min. 24 sec.
CorelDRAW (Direct): 2 min. 6 sec.
CorelDRAW (File): 1 min. 49 sec.

Courier
Prestige
Sans serif
Roman



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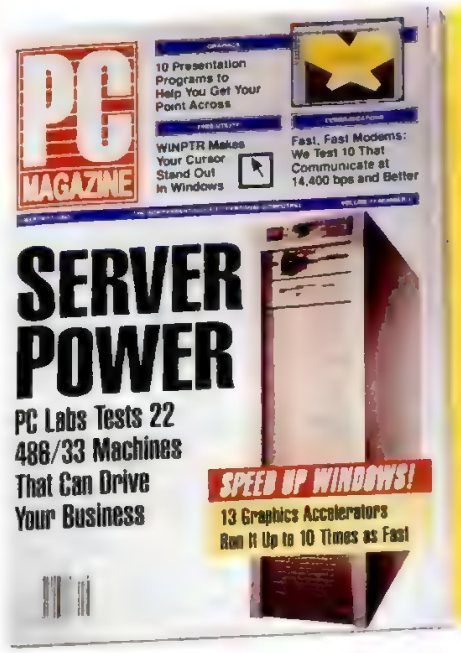

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PC MAGAZINE EDITORS' CHOICE
March 17 1992
Northgate Elegance 433e

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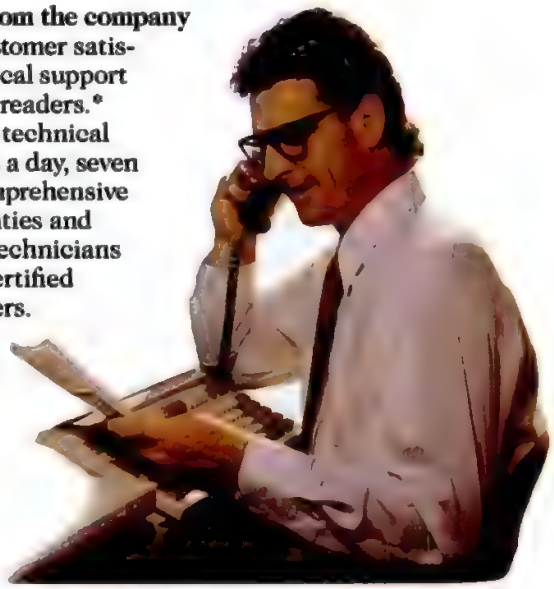

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CIRCLE 182 ON READER SERVICE CARD

Seikosha SP-2400 — $329

9-pin narrow-carriage dot matrix printer

Sans Serif
Courier
Prestige
Gothic

Draft Text Speed: 96 cps
Quality Text Speed: 32 cps
Graphics Speed: 0.7 gppm

WINDOWS APPLICATIONS:
Word for Windows: 5 min. 23 sec.
CorelDRAW (Direct): 1 min. 23 sec.
CorelDRAW (File): 1 min. 7 sec.

Seikosha SP-2415 — $549

9-pin wide-carriage dot matrix printer

Sans Serif
Courier
Prestige
Gothic

Draft Text Speed: 94 cps
Quality Text Speed: 31 cps
Graphics Speed: 0.8 gppm

WINDOWS APPLICATIONS:
Word for Windows: 5 min. 27 sec.
CorelDRAW (Direct): 1 min. 22 sec.
CorelDRAW (File): 1 min. 7 sec.

Star Micronics NX-2430 Multi-Font — $399

PC MAGAZINE EDITORS' CHOICE

24-pin narrow-carriage dot matrix printer

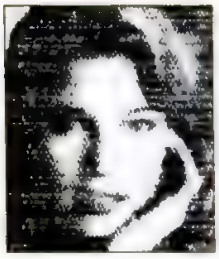
Roman
SanSerif
Courier
Prestige

Draft Text Speed: 90 cps
Quality Text Speed: 45 cps
Graphics Speed: 1.1 gppm

WINDOWS APPLICATIONS:
Word for Windows: 2 min. 53 sec.
CorelDRAW (Direct): 1 min. 10 sec.
CorelDRAW (File): 0 min. 56 sec.

Tandy DMP 310 Slimline Printer — $499.95

24-pin narrow-carriage dot matrix printer



LinePrinter
Courier

Draft Text Speed: 43 cps
Quality Text Speed: 30 cps
Graphics Speed: 0.3 gppm

WINDOWS APPLICATIONS
Word for Windows: 5 min. 51 sec.
CorelDRAW (Direct): 2 min. 3 sec.
CorelDRAW (File): 1 min. 54 sec.

Unisys AP 1371 — $3,295

PC MAGAZINE EDITORS' CHOICE

18-pin wide-carriage printer

Sans Serif
Courier

Draft Text Speed: 281 cps
Quality Text Speed: 129 cps
Graphics Speed: 1.9 gppm

WINDOWS APPLICATIONS:
Word for Windows: 2 min. 16 sec.
CorelDRAW (Direct): 0 min. 43 sec.
CorelDRAW (File): 0 min. 24 sec.

plans to fit a printer to every niche of the mid- to high-end desktop dot matrix printer market. If none of these fit your exact needs, though, check back in a while; AMT has plans to add another batch of models soon.

Advanced Matrix Technology Inc., *765 Flynn Rd., Camarillo, CA 93012; 800-992-2264, 805-388-5799; fax, 805-484-5282.*

AMT Accel-212 *List price: $469; 504K RAM upgrade, $295; black ribbon, $6.25. Dimensions (HWD): 6 x 16.5 x 14.4 inches. Weight: 18.5 pounds. Emulations: Epson FX, Lexmark 2380.*

AMT Accel-214 *List price: $529; 504K RAM upgrade, $295; black ribbon, $10. Dimensions (HWD): 6 x 21.4 x 14.4 inches. Weight: 21.5 pounds. Emulations: Epson FX, Lexmark 2381.*

AMT Accel-242 *List price: $529; 504K RAM upgrade, $295; black ribbon, $6.25. Dimensions (HWD): 6 x 16.5 x 14.4 inches. Weight: 19.5 pounds. Emulations: Epson LQ; Lexmark 2390.*

AMT Accel-244 *List price: $595; 504K RAM upgrade, $295; black ribbon, $10. Dimensions (HWD): 6 x 21.4 x 14.4 inches. Weight: 22.5 pounds. Emulations: Epson LQ, Lexmark 2391.*

AMT Accel-292 *List price: $795; 504K RAM upgrade, $295; black ribbon, $6.25. Dimensions (HWD): 6 x 16.5 x 14.4 inches. Weight: 19.5 pounds. Emulations: Epson FX, Lexmark 2380.*

AMT Accel-294 *List price: $895; 504K RAM upgrade, $295; black ribbon, $10. Dimensions (HWD): 6 x 21.4 x 14.4 inches. Weight: 22.5 pounds. Emulations: Epson FX, Lexmark 2381.*

Circle 511 on reader service card

ALPS America

ALPS DMX800

Brother International Corp. USA

Brother M-4309A

BY BRUCE BROWN AND WINN L. ROSCH

If you need high-speed, high-production printing, the Brother M-4309A and the nearly identical ALPS DMX800 are fast at text output. But these sturdy wide-carriage 18-pin units (both manufactured by Brother International Corp.) are costly—$2,195 each—and finicky. Both jam tractor-fed paper but are solid performers when working with cut sheets.

Each printer uses a push tractor; an optional pull tractor costs $149 from either ALPS America or Brother. You can also buy a $549 150-sheet single-bin cut-sheet feeder and a $1,295 triple-bin cut-sheet feeder that holds a total of 300 sheets and 50 envelopes.

ALPS DMX800, Brother M-4309A

Apart from loading continuous-form paper into the tractor, paper handling is automatic. Press the top-of-form button and either continuous-form or bin-fed paper threads itself. Another push button lets you change the paper-feed source—cut sheets in the bin and continuous-form paper on the tractor—without unloading either.

When continuous-form paper goes awry (as it did several times when we tested this printer), pieces inevitably lodge in the paper sensors molded into the push tractors.

A 32-character LCD and six membrane switches control setup and adjustments such as the printhead-to-paper gap, speed (draft versus NLQ), and typeface. The menu-control system is straightforward but not streamlined. Most of the functions are set-and-forget operations, however, so dealing with the command hierarchy is a minor handicap.

The M-4309A we tested had 96K of RAM, though the company said that this printer has since started to ship with 192K. We tested the DMX800 with 128K of RAM.

For output and performance, both printers are commendable. The text and graphics output is sharp, even in draft mode. The M-4309A adds two fonts (Orator and a line printer font) to the seven offered by the DMX800; the fonts are mostly standard, despite some odd names (such as Brougham, which looks like Courier). Both units have five resident bar code fonts.

These two printers were among the fastest we tested this year. On PC Magazine Labs' Text Speed test, the M-4309A produced 258 cps in draft mode, slightly behind the DMX800's 265 cps. In the Epson emulations' quality mode, the M-4309A scored 97 cps, and the DMX800 turned in 98 cps. But the M-4309A, using the same Microsoft Windows driver, produced the second-fastest score on our Word for Windows test, with the DMX800 trailing by almost a minute.

Color capability is built-in, though you will need to buy a color ribbon to use it ($39.95 from ALPS and $44.95 from Brother). A color test sample showed clear color separation, though these high-production units usually have limited reasons for using color.

THE ALPS' EDGE

Although most of the ALPS DMX800's features mirror the M-4309A's, the DMX800 deserves a second look.

The biggest difference is the DMX800's automatic printhead adjustment: The printhead senses and accommodates paper thickness, which eliminates the aggravation of manually changing settings to attain the proper impact force for clear, complete type.

The M-4309A has a slightly lower street price ($1,550 compared with around $1,760 for the DMX800), but the DMX800 has its extras. Although both printers jam tractor-feed paper, as long as you use cut sheets, you won't be disappointed in the quality and speed of these rugged printers.

ALPS America, *3553 N. 1st St., San Jose, CA 95134; 408-432-6000; fax, 510-734-8222.*

ALPS DMX800 *List price: $2,195; 150-sheet single-bin cut-sheet feeder, $549; 300-sheet triple-bin cut-sheet feeder, $1,295; pull tractor, $149; black ribbon, $34.95; color ribbon, $39.95. Dimensions (HWD): 8.2 x 23.9 x 16.5*

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Dennis Lubash,
Z-DIRECT
Sales Associate.
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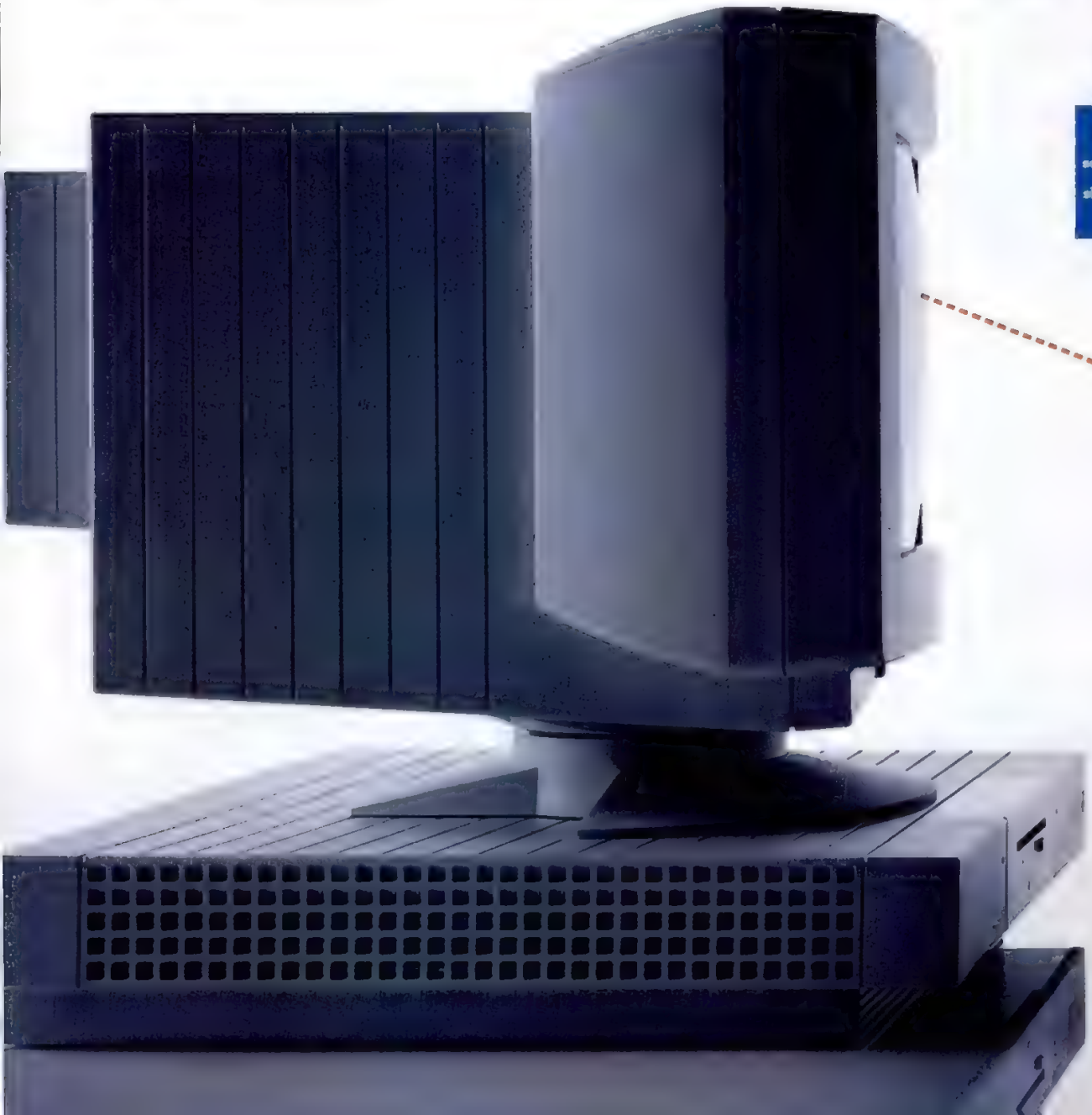

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Z•DIRECT Account Executive.
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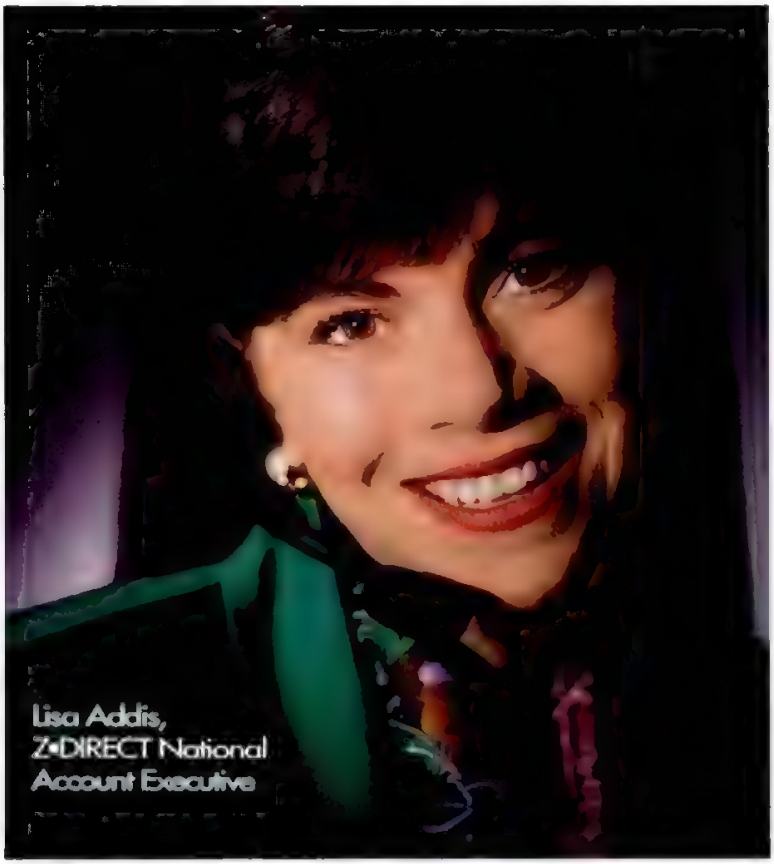

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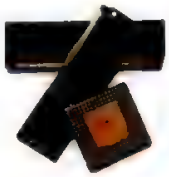

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*Battery life depends on application used, power management features selected and peripherals attached.

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- **Pre-installed network client software for Novell NetWare, Microsoft LAN Manager, Banyan VINES**
- **Ethernet-compatible high-speed communication port for LAN connectivity**
- 3.5" 1.44MB floppy drive
- State-of-the-art modular "snap-in" system design with 2 ISA slots
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- Dual password security protection
- Serial, parallel, mouse, keyboard, video ports
- Microsoft mouse
- One-year limited warranty and on-site service included with extended Z-CARE service available

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Z-SERVER™ 425SE
"Entry Level"

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- 512KB of video RAM for Super VGA
- 384-watt power supply
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Helen Lim,
ZDS Systems
Software Engineer

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Circle 512 on reader service card

Brother International Corp. USA, *200 Cottontail Ln., Somerset, NJ 08875; 800-284-4357, 908-356-8880; fax, 908-469-5167.*

Brother M-4309A *List price: $2,195; 150-sheet single-bin cut-sheet feeder, $549; 300-sheet triple-bin cut-sheet feeder, $1,295; pull tractor, $149; black ribbon, $34.95; color ribbon, $44.95. Dimensions (HWD): 8.2 x 23.9 x 16.5 inches. Weight: 44 pounds. Emulations: Epson EX-1000, Epson FX, IBM Proprinter.*
Circle 513 on reader service card

Axonix Corp.

Axonix MilWrite

BY BRUCE BROWN

The descendant of a portable printer used in the Desert Storm operation, the Axonix MilWrite works in almost any environment. But its $1,395 list price (about $1,100 street price) and slower-than-desktop speed restrict this 9-pin portable to situations that put a premium on durability.

Axonix's narrow-carriage printer is a repackaged version of the nonportable Seikosha SP-2400: The MilWrite has gained slightly altered electronics (it can run on batteries) and a much sturdier case. The MilWrite's design specs call for it to print in an inch and a half of water, 20-mph winds, or sandstorms. The unit measures 5 by 14.3 by 10.5 inches (HWD) and weighs 10 pounds with its included 1-pound battery. The separate 0.8-pound AC adapter/battery charger it includes works with 60-Hz 110V/220V outlets. The printer includes a 25-pin nonstandard parallel-port connector cable.

The nickel cadmium battery pack provides about 50 minutes of continuous text printing. The battery recharges in 6 hours with the printer off and is good for 2,000 charges. An optional $19.95 battery carrier lets the unit run on standard alkaline batteries.

A $59.95 memory option expands the standard 8K buffer to 32K. The internal push tractor handles continuous-form paper or single sheets. In continuous-form mode, you can keep the printer's top latched and unscrew small hatches on the rear and top for paper input and output. The top lifts for single sheets. (A $39.95 50-sheet cut-sheet feeder should ship before year's end.)

The MilWrite has a front-mounted control panel with membrane buttons for selecting the typeface and print mode, among other features. But there is no LCD panel, and the only user settings are system defaults such as the emulation and the use of a slashed zero, each set via mechanical DIP switches.

Although nearly identical to the SP-2400 desktop unit's sluggish performance, the MilWrite's Text Speed test result in both emulations (Epson and IBM) is acceptable for a portable: 95 characters per second in draft mode and 32 cps in quality mode.

Text and graphics print quality are typical for a 9-pin printer that handles 240 by 216 dots per inch. Text output was best in Gothic, one of the MilWrite's five resident fonts.

If you need a portable printer for conventional use, other vendors sell portable dot matrix and ink jet printers that weigh less and cost less than the MilWrite does. In fact, by the time you read this, Axonix should be shipping its $549 Axonix ThinWrite 2000 (which is basically the MilWrite without the armament). But for military, scientific, or industrial uses in the field, the Axonix MilWrite's ability to withstand rough treatment makes it highly recommendable. It isn't cheap, but it's ready whenever you are.

Axonix Corp., *1214 Wilmington Ave., Salt Lake City, UT 84106; 800-866-9797, 801-466-9797; fax, 801-486-6204.*

Axonix MilWrite *List price: $1,395. 24K RAM upgrade, $59.95; 50-sheet snap-on paper tray for multipart forms, $79.95; roll-paper holder, $19.95; black multistrike ribbon, $13; extra battery, $79.95; carrier for alkaline batteries, $19.95; extra AC power adapter, $29.95; cigarette lighter adapter, $19.95; vehicle mounting plate, $29.95; serial interface, $49.95; carrying case, $69.95. Dimensions (HWD): 5 x 14.3 x 10.5 inches. Weight: 9 pounds; with battery, 10 pounds.; with battery and AC adapter, 10.8 pounds. Emulations: Epson FX, IBM Graphics Printer, IBM Proprinter.*
Circle 514 on reader service card

C-Tech Electronics Inc.

C. Itoh ProWriter C-610II Document Printer
C. Itoh ProWriter C-615II Document Printer

BY M. DAVID STONE

Excellent paper handling is no small feat. Both the $799 C. Itoh ProWriter C-610II Document Printer and its $1,175 wide-carriage twin, the C. Itoh ProWriter C-615II, manage to carry it off with aplomb. These 24-pin printers also produce good text output at reasonable speeds.

Although the ProWriter printers bear the C. Itoh name, they are manufactured by Tokyo Electric Co. (TEC) and sold by C-Tech Electronics, a joint venture of C. Itoh & Co. and TEC.

This pair's paper-handling abilities stem from a flatbed paper path. The tractor-feed paper mounts on a push tractor, and rather than threading under a roller, it follows a straight path through the printer and out the front. The printhead and ribbon are mounted above the paper, printing straight down, so the printed side comes out faceup. The flatbed path makes paper jams all but impossible and allows the printer to handle card stock and multipart forms with ease.

Both units provide an alternate feed through the front tray. If you park the tractor-feed paper, you can feed an envelope or cut sheet through the front. A $349 100-sheet single-bin feeder works only with the C-610II.

The front panel on both printers features four buttons, a 16-character LCD, and status lights (power on, on-line, alarm, and LQ mode). Most of the button combinations are clearly marked, and the LCD messages are easily understandable. Among the features available from the front panel are form feed, font change, pitch change, and paper parking.

C. Itoh ProWriter C-610II Document Printer,
C. Itoh ProWriter C-615II Document Printer

Both printers come with 26K of RAM (not expandable) and two emulations: IBM Proprinter and Epson LQ.

GOOD PERFORMANCE AND OUTPUT

On PC Magazine Labs' Text Speed test in quality mode (IBM emulation), the C-610II produced speeds of 55 characters per second. The C-615II was slightly but not significantly faster, at 59 cps.

Output quality for both 360-dot-per-inch printers is more than acceptable. The draft text characters are thin and clearly from a dot matrix printer but reasonably dark and highly readable. The four resident letter-quality fonts are all monospaced, and all yield dark, fully formed characters, as do those on the 14 optional font cartridges ($54.90 apiece). Both handled thin lines well, filled in solid areas, and retained details in test images, though the C-615II had some banding problems.

One feature not available in the review units was bar code generation. According to C-Tech, this capability was added during the second production run. If you get a printer without the bar code feature, C-Tech will swap the firmware at no charge. C-Tech also expects to have color versions soon, though the monochrome versions will not be upgradable.

The biggest strength of both printers is their rock-solid, reliable paper feed. With likely street prices of $549 for the C-610II and $775 for the C-615II, this pair will attract users who need reasonable text speed, quality output, and first-class paper handling.

C-Tech Electronics Inc., *P.O. Box 19673, 2515 McCabe Way, Irvine, CA 92713; 800-347-4017 ext. 4473, 714-833-1165; fax, 714-757-4533.*

C. Itoh ProWriter C-610II Document Printer *List price: $799; font cartridges, $54.90 each; 100-sheet single-bin cut-sheet feeder, $349; six black ribbons, $88.76. Dimensions (HWD): 8.3 x 18.5 x 17.4 inches. Weight: 22 pounds. Emulations: Epson LQ, IBM Proprinter.*

EDITORS' CHOICE ▶ **C. Itoh ProWriter C-615II Document Printer** *List price: $1,175; font cartridges, $54.90 each; six black ribbons, $138.18. Dimensions (HWD): 8.3 x 24.5 x 18 inches. Weight: 26.5 pounds. Emulations: Epson LQ, IBM Proprinter.*

Circle 515 on reader service card

Citizen America Corp.

Citizen GSX-240

BY WINN L. ROSCH

Scalable fonts, quality text output, and reasonable speed are all attributes of the Citizen GSX-240. But the $519 printer lacks the wherewithal for heavy-duty work.

Succeeding the GSX-140 Plus at the top of Citizen America Corp.'s narrow-carriage dot matrix printer line, the GSX-240 adds scalable fonts and a more refined control system. It retains the older machine's 24-wire mechanism, with its precision and its unwanted delicacy. During testing, the GSX-240 could not print two graphics pages back-to-back without stopping to cool its printhead. Still, it managed a decent 1.3 graphics pages per minute on our Graphics Speed test.

The unit's score on our Text Speed test was good: 60 characters per second in quality mode (Epson emulation). But it faltered on our Windows applications tests, taking over 10 minutes to print a WinWord document. This indicates problems with Citizen's Windows driver.

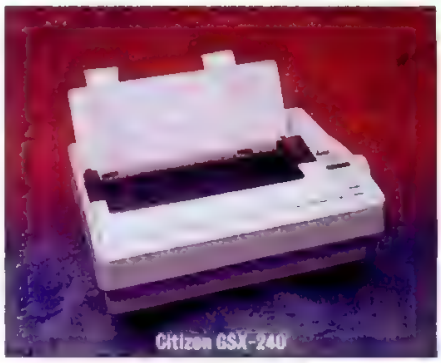
The graphics output of the 360-dpi GSX-240 was somewhat grainy and gray, but text using the six resident fonts (two of which are scalable) proved acceptable. A $79 cartridge provides two additional scalable fonts. Although the printer's design is somewhat flimsy, the dual-purpose tractor converts quickly from push to pull operation. Paper parking (in push mode) and loading is push-button easy. You can use continuous-form paper or cut sheets (a 100-sheet cut-sheet feeder is a $169 option); you can switch media without unloading continuous-form paper.

As with all Citizen printers, the GSX-240 uses a multimode push-button command system. The GSX-240 adds a nine-character, six-icon display, which augments the four push buttons that control setup and everyday commands. Macros let you program four settings for push-button recall. A $79 memory-expansion cartridge boosts the 8K standard buffer to 136K. A $59 color kit consists of a slide-in motor that supports a four-color ribbon. The motor installs easily and produces unexciting dot matrix color output.

The GSX-240, which costs about $315 on the street, may be a contender if your application puts function and intelligence above brute force and grace. But this printer cannot handle the demands of heavy office use.

Citizen America Corp., *2450 Broadway, #600, Santa Monica, CA 90404; 310-453-0614; fax, 310-453-0614.*

Citizen GSX-240 *List price: $519; 128K RAM upgrade, $79; font cartridges, $75 each; 100-sheet single-bin cut-sheet feeder, $169; manual sheet feeder, $59; color option, $59; black ribbon, $7.99 (fabric), $11.50 (film); color ribbon, $25.99; serial interface, $49; printer stand, $49 Dimensions (HWD): 5.4 x 17 x 12.6*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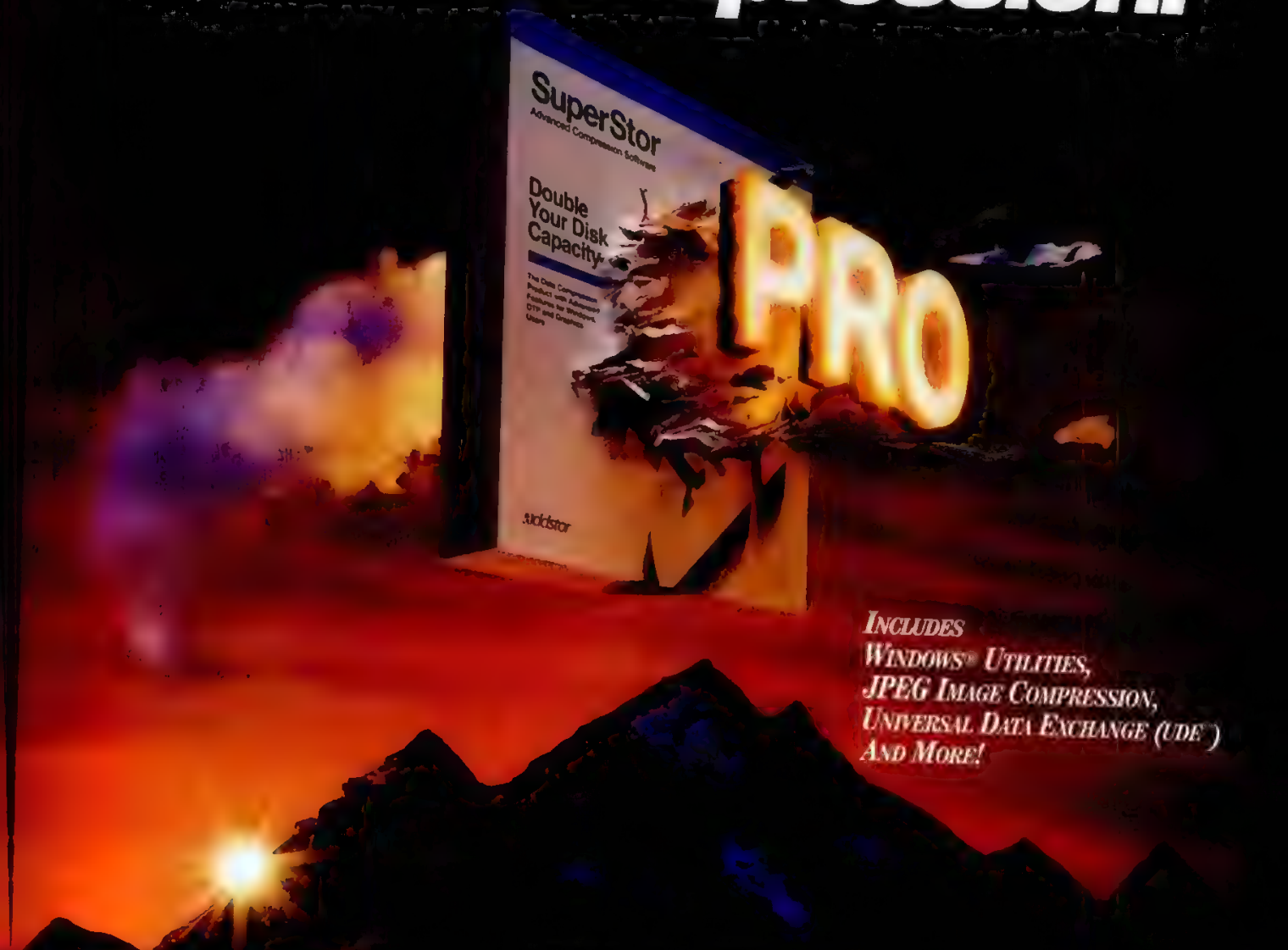

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Automount	✔	✔	
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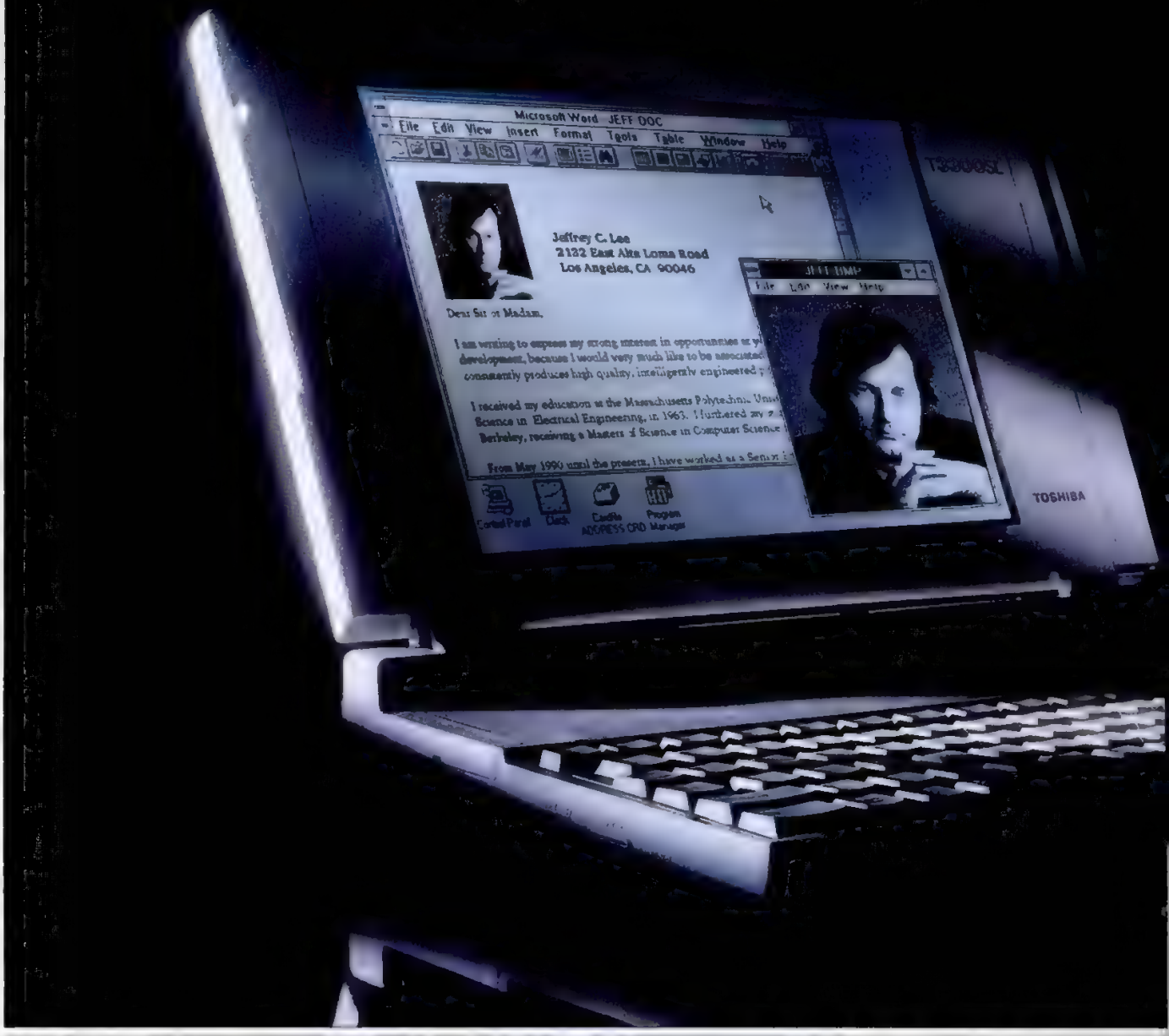

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August 1992
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CIRCLE 379 ON READER SERVICE CARD

inches. Weight: 11.4 pounds. Emulations: Citizen GSX, Epson ESC/P2, Epson LQ, IBM Proprinter.
Circle 516 on reader service card

Dataproducts Corp.

Dataproducts LX 455

BY WINN L. ROSCH

Big and rugged are two good ways to describe the Dataproducts LX 455, a 74-pound line printer emulator designed for heavy-duty printing. The $4,595 price tag buys you sturdiness and performance.

The unit includes five built-in typefaces, along with Postnet and seven other bar codes. It also has a 12K buffer, though no memory expansion options. Print quality is bold and dark but not particularly sharp. The 33-wire printer has a maximum resolution of 120 by 144 dots per inch. During testing, the new ribbon bled a little, obscuring some fine detail.

The only line printer emulator with a single printhead that we tested, the LX 455 was also the only one that slowed down significantly in draft mode from narrow-carriage testing (443 lines per minute) to wide-carriage testing (350 lpm, the slowest score of this group). But in quality mode, it took the lead in narrow-carriage printing, with 194 lpm. Its Graphics Speed score was the fastest of the group—2.1 gppm—though its scores on our Windows applications tests weren't equal to its raw throughput.

The LX 455 accommodates only continuous-form paper (up to 17 inches wide) and relies solely on electronic control: There is no platen roller. A 16-key keypad with Chicklet-style keys and a 32-character readout provide menu-driven control and let you position paper exactly. Paper-handling is smooth and fast. If you don't like the five default settings, create your own.

Although the harmonica-style ribbon plugs in easily, the change is not completely smudge-free, due to a safety cover over the printhead. A small membrane keypad inside helps you load (up to an original and five copies) into the dual-tractor straight-line path, up from the bottom and out the top rear.

The LX 455 is the kind of printer you can plug in at the end of a server and expect to churn out reams of paper without hassle. Sold through direct channels, the LX 455 delivers steady if uninspired output under circumstances that would destroy lesser printers in a few months.

Dataproducts Corp., *6219 DeSoto Ave., Woodland Hills, CA 91365; 800-334-3174, 818-887-8000; fax, 818-887-8443.*

Dataproducts LX 455 *List price: $4,595; QMS Magnum emulation, $895; Demand Document emulation, $295; black ribbon, $45; printer stand, $495. Dimensions (HWD): 16 x 29 x 20 inches. Weight: 74 pounds. Emulations: Dataproducts LB series; Epson EX-1000; Epson FX; IBM Proprinter; Printronix P-series; Printronix S-series.*
Circle 517 on reader service card

Dot Matrix Quality: *The Terms*

by M. David Stone

You've finished writing your letter and have formatted it with care. But the final result depends on what happens where the printhead meets the paper. You may think that to get good-looking output from an impact printer all you need to do is make sure you use a model with 24 pins. But if you care about output quality, you need to know at least a bit more than that.

Dot matrix printers offer a wide range of quality levels for text output. The printer manufacturers also offer a confusing array of names for those levels; some use different names for about the same-quality level, while others use identical names for noticeably different levels.

To make sense of it all, you must draw a distinction between perceived quality and the print modes—between what the output looks like and the mechanics that were behind producing that output.

WHAT YOU SEE IS WHAT YOU SEE

The scale for measuring perceived quality is straightforward. High-speed draft is ragged, often lacking true ascenders and descenders, and likely to give you eyestrain if you read much of it in one sitting. Draft quality includes true ascenders and descenders, and most people will find it readable for extended periods.

Correspondence quality is highly readable but obviously from a dot matrix printer. Near-letter-quality characters might be mistaken for fully formed characters if you don't look closely. Letter-quality characters are to the naked eye indistinguishable from fully formed characters.

Even fully formed characters show variation. Low-end printers produce thick characters with fuzzy edges, and high-end printers print thin characters with crisp, sharp edges—like an IBM Selectric typewriter using a carbon ribbon. Don't expect Selectric-level output from a dot matrix printer, though. Even the best laser printers merely approach it.

HOW YOU GET WHAT YOU GET

As you might suppose, many variables determine quality—most notably the ribbon, pin diameter, and number of dots in the character matrix. These all determine whether a given printer produces LQ or NLQ output in its highest-quality mode.

Digital Equipment Corp.

DEC LA 75 Plus Companion Printer
DEC LA 424 MultiPrinter

BY BRUCE BROWN

Digital Equipment Corp.'s $549 narrow-carriage DEC LA 75 Plus Companion Printer and $1,349 wide-carriage DEC LA 424 MultiPrinter deliver quality text and graphics at competitive speeds. Both these sturdy 24-pin dot matrix printers work well with IBM PCs, but their greatest value is for companies that use both PCs and Digital minicomputers.

The two printers, which handle 360 by 180 dots per inch, come with an IBM Proprinter emulation mode and Digital PPL native mode. Both of these systems have a built-in color printing capability, though the only color compatibility is in Digital PPL mode.

SOME THINGS IN COMMON

Along with a standard parallel-port printer interface, each has a proprietary DEC423 serial interface and comes with a 10-foot DEC423 cable to attach to Digital systems.

Both printers have 8K buffers (there is no expansion option) and rear paper feeds (the LA 75 Plus also has a bottom feed). Paper parking and paper loading for these units are controlled from a front control panel. The LA 424 has the added advantage of a 16-character LCD menu.

DEC LA 75 Plus Companion Printer, DEC LA 424 MultiPrinter

Apart from the standard paper-handling features, the LA 75 Plus has an optional $250 75-sheet single-bin cut-sheet feeder. For the LA 424, an optional $795 triple-bin cut-sheet feeder holds 200 sheets per bin.

Both units have one resident font: Courier. Five optional font cartridges for the LA 75 Plus cost $50 apiece; the LA 424's eight optional font cartridges also cost $50 each.

Both printers come with a one-year warranty that includes on-site service—this is an important feature for offices where printing can't stop for long. But Digital sells its products directly; the only possible discounts are for quantity purchasers.

LA 75 PLUS COMPANION PRINTER

The $549 LA 75 Plus, an upgrade to the still-available 9-pin DEC LA 75 we reviewed in our printer issue of November 13, 1990, offers a higher speed and better multiple-port features.

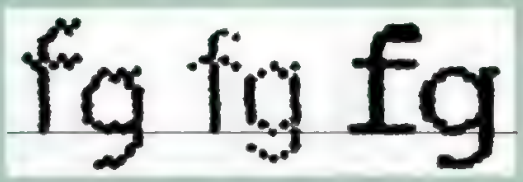
If you simultaneously connect a PC and a Digital computer to the LA 75 Plus parallel and serial interfaces, the printer automatically detects which port is receiving instructions and switches to the

The pin diameter matters because smaller dots yield better-quality edges. Most 9-pin printers use 0.3-millimeter pins, while most 24-pin printers use 0.2-millimeter pins. There are exceptions, in large part because smaller-diameter pins are less durable. Okidata, for example, uses 0.34- and 0.36-mm pins in many 9-pin printers and in its 24-pin Microline 380 but a 0.2-mm pin in the 24-pin Microline 393.

The number of pins is not a determining factor for quality. In theory, you could get LQ output with a single pin. With fewer pins, however, it usually takes longer to create a character for any given number of dots per character.

A survey of printer vendors shows a surprising degree of consistency for 9-pin character matrices. Epson America's matrices are typical: 7 dots horizontal by 9 vertical for high-speed draft, 9 by 9 for draft, and 23 by 18 for NLQ. You can, however, find differences. Panasonic's matrix, for example, uses 18 by 18 for NLQ, while Okidata uses 9 by 17 in some printers and 17 by 13 in others.

Matrices for 24-pin printers show more variability, though mostly in draft modes. LQ is typically between 30 by 24 and 35 by 24. Advanced Matrix Technology offers an unusual 31 by 32 matrix in its Accel-500 Series printers, thanks to a pin arrangement of three rows of 8 instead of the usual two rows of 12. Panasonic is one manufacturer that offers a super-letter-quality mode on some printers, with a character matrix of 30 by 48 dots.



Notice the difference in output quality among draft, high-speed draft, and letter-quality modes, particularly in the ascenders and descenders.

Panasonic also offers an unusual pin arrangement in its 24-pin Quiet Series. The character matrix is the same one used by the company's standard printers, but because the pins are arranged in a diamond shape rather than in two parallel rows, they don't all bang the ribbon at once. As any parent of a toddler can tell you, less banging means less noise. In addition to their default quiet performance, the Quiet Series printers also offer a Super Quiet mode. As with the quiet mode available from some other printer manufacturers, this simply slows printing down so that fewer pins hit the ribbon in any given length of time.

The lesson is simple: The pin diameter and character matrices offer the best clues to judging print quality. But ultimately, the only way to map perceived quality levels to print modes is on a printer-by-printer basis: by looking at the output for each mode. □

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Laplink Pro has pull-down menus, file transfer capabilities over a modem or cable, and the fastest transfer speeds in the industry. With LapLink's remote installation capability, you can transfer files to a PC that doesn't have Laplink Pro. Laplink Pro will install itself over either the modem or cable. Use the Synchronize function to make the files in two directories identical. Context sensitive help will guide you through any task. Comes with everything you need to start transferring files, including both serial and parallel cables. Whether you're transferring files across a hallway or a hemisphere, Laplink Pro will cover the distance. Also available: ***LapLink Pro Upgrade*** **UP0584 $55. Publisher: Traveling Software UT2074**

$109

Smart Label Printer Plus

With the Smart Label Printer Plus, you can make labels for envelopes, file folders, diskettes, and name tags - the convenient way. It can print one or two in a hurry, and handle long mailing lists. It prints in the background, and even prints postal bar-codes. Automatic label positioning and formatting eliminates trial and error and wasted paper. The software stores as many formats as you need, and the printer handles several fonts and sizes. **Also available:** ***Smart Label Printer Plus for Windows*** **PR2830 $179 Manufacturer: Seiko** ***Smart Label Printer Plus for DOS*** **PR2180**

$142

★CorelDRAW! 3.0

A new Era in PC Graphics! CorelDRAW, winner of over 50 international awards, is the PC graphics software for everyone! CorelDRAW 3.0's enhanced features include graphic design layers; editable preview; improved 3D effects; and powerful data-driven charting, paint and photo editing, and presentation packages: CorelCHART, Corel PHOTO-PAINT, and CorelSHOW. It comes with 154 TrueType fonts, and over 4600 symbols and clip art images. And as an unprecedented bonus, Corel has included a CD-ROM with over 12,000 clip art images and over 250 fonts! Also included: dozens of fill patterns, dotted and dashed line styles, and arrowheads, 31 import/export filters, free Pantone and TRUMATCH licenses, and free utility programs - CorelTRACE, and Mosaic. **Also Available on CD ROM. CD0580 $369. Publisher: Corel Systems GR5443/5**

$379

★Close-Up Dual Pack Remote for Windows & DOS

Winner of *PC Magazine's* "Editors Choice", "Best of 1991" and *PC World's* "Best Buy." Close-Up 4.0 remote communications software lets you take control of PCs miles away by modem. Remotely view & operate multiple Windows, DOS and VGA/EGA graphics applications with record-breaking speed. Run your office PC from home or on the road via laptop. Help others at any location. Access networks. Fastest remote screen & file transfers. Get Close-Up 4.0 Dual Pack (Both host & remote sides) **Publisher: Norton-Lambert CM0503/5**

$119

★FastLynx 2.0 Data Transfer for Windows & DOS

FastLynx is two programs for the price of one! High speed data transfer between computers up to 8 megs per minute and remote computer disk drive and printer sharing. FastLynx is accurate and easy to use. Just connect two PC's with the cables included to either the serial or parallel port then, simply move data from one directory to another. On a Novell network, bypass the server for quick easy station-to-station transfers. *PC Magazine* "Editors Choice." **Publisher: Rupp Corp. UT2644**

$99

The UnMouse

With the UnMouse, all you need is this innovative mouse alternative, plus your finger. No annoying mice to locate, orient, and roll. No moving parts to break. No balls to clog, slip, or clean. No moving tails to spill coffee. The UnMouse does everything a mouse can - only faster, easier, and in less space. To move the cursor, simply slide your finger over the glass surface. To make a selection, merely press down. The UnMouse also serves as an extended keyboard. Tap the large red button and you have a Power Keypad with sixteen keys instantly available to execute macros (60 in advanced mode). With its one million touch points, the UnMouse also performs as a small graphics tablet. **Manufacturer: Microtouch IN0810**

$165

MultiSound *Hi-res 16-bit sound card*

Winner of the "1992 WIN 100 award" from *Windows Magazine*. MultiSound has been praised by critics as the best multimedia sound card available. It is the only sound card which provides audiophile quality. It offers 16-bit CD-quality hard disk recording, as well as a professional sample player synthesizer for the only "real sounding" MIDI on the sound market. Multisound also includes a Motorola 56001 Digital Processor chip, so that future Windows applications only require a software update for support. Requires 2MB of RAM, Windows 3.1, a hard disk, and a mouse. **Manufacturer: Turtle Beach EX2270**

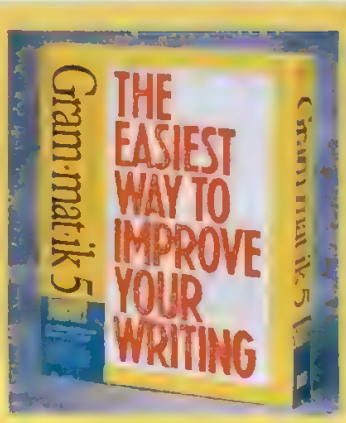
$699

Grammatik 5 for DOS

Grammatik 5 for DOS, the #1 grammar and style checker, proofreads documents for thousands of errors in grammar, style, usage, punctuation, and spelling. It works just like a spelling checker from inside WordPerfect, Microsoft Word and all major DOS word processors. Grammatik 5 features MorProof, a technology that analyzes every word in a document by its roots for extremely accurate grammar and spell checking. Choose from 10 writing styles and three custom styles to ensure that your documents are being proofread for the appropriate audiences. Use the Rule Designer to create custom rules for your writing style. **Also available:** ***Grammatik 5 for Windows*** **WP0514 $55. Publisher: Reference Software**

Grammatik 5 for DOS **WP0334**

$55



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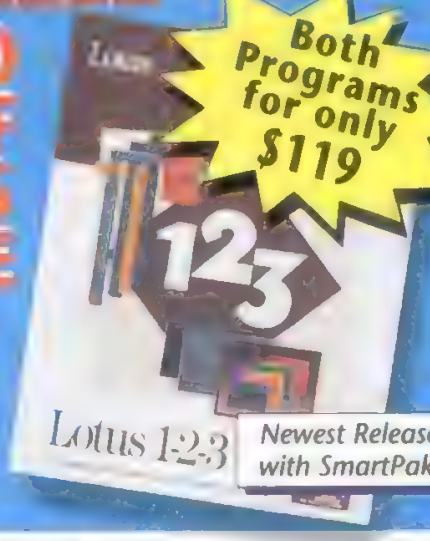

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Actual packaging may vary. Lotus 1-2-3 Release 1.1 Upgrade may require proof of spreadsheet ownership. Call for details.

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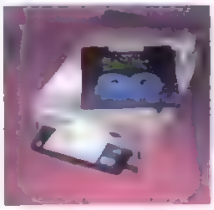
Bernoulli PC Powered



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Manufacturer: Iomega
DR2240

$499

OPTIMA 24 + FAX96

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Manufacturer: Hayes MM2270

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GR5291

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PR1120	25 Cartridges in One!	269
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Software Marketing		
ED3734	Autoworks	49
ED3454	CHEMISTRY WORKS	42
ED3034	Bodyworks	49
The Software Toolworks		
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GR5383	★Aldus IntelliDraw	199
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GR5543	★Fontographer for Windows	265
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GR3074	★FontMonger for Windows	89
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GR1994	★After Dark 2.0 for Windows	29
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BS5004	Graftek 2.0	115
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BS0774	◆dBASE IV 1.5	548
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GR557-4

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Publisher: Abracadata
HH0094

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Interiors **EN2704 $33.**
Landscape **EN2714 $33.**
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$33

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Design precision, to-scale (HO, N, O, Z, S, G, I or custom scale) layouts using unique track-laying tools. A complete set of drawing tools allows you to add rolling stock, scenery, and structures to your layout, then run a fully-operating simulation. It's better than a model railroad in your basement. **Publisher: Abracadata EN2684**

$35

★PerFORM PRO Plus

PerForm PRO Plus, is the perfect tool for a full range of business applications. Design professional-quality forms with PerForm's object-oriented design tools and unique libraries of form and graphic objects. PerForm PRO Plus gives users powerful database functionality. Access multiple dBASE, Paradox and Clipper databases in a single form; Convert data from one database format to another; create databases directly from your forms; or have your databases create forms for you - automatically! PerForm includes a powerful macro language giving you the ability to build "form systems" with customized menus, toolbars and commands. Includes 5 "Ready to Use" form systems like Human Resources and Order Entry. Full DDE and OLE capabilities. Includes Delrina's WinFax PRO
Publisher: Delrina Technologies BS7243/5

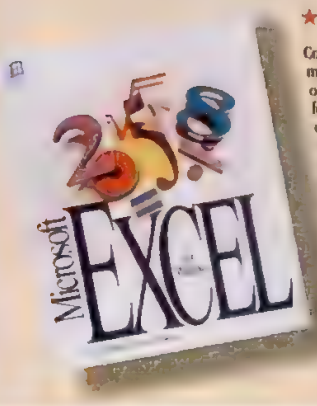
$248

★Microsoft Windows 3.1

Discover the point-and-click graphical simplicity of Microsoft Windows 3.1, and using your PC will never be easier. Create terrific-looking documents in less time. Sail through your work more easily. And share information between your favorite DOS and Windows applications. If you're already using Windows, an improved setup routine loads Windows onto your system automatically, while maintaining your current configuration. System speed and reliability has been increased with more efficient memory use, better laptop display and efficiency, and a new Application Reboot feature, which keeps Windows and other applications up and running while you reboot a problem application. The File Manager has been improved with enhanced Drag and Drop capabilities. Once you've experienced the Windows environment, you'll never want to leave.
Also available: ***Microsoft Windows 3.1 Upgrade*** **UP0243/5 $39.**
Publisher: Microsoft

Microsoft Windows 3.1
OP0163/5

$89

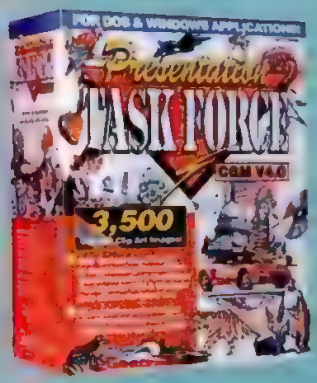


★Microsoft Excel 4.0 for Windows

Complex calculations and data presentations become easy with Excel 4.0! Put your most frequently used functions on the customizable Toolbar. Click a button to carry out such operations as worksheet formatting, summing numbers, creating formulas, organizing data, and creating charts. Type familiar Lotus 1-2-3 commands and get automatic instructions/demonstrations of the equivalent Excel command. Drag and drop allows you to move data at will. Autofill intelligently projects trends. Create and view multiple "what if" scenarios with the Scenario Manager. And enjoy quick, convenient one-step access to 16 professionally designed formats. Requires Windows 3.0 or later. **Also available:** ***Microsoft Excel 4.0 for Windows Live Upgrade*** **UP0093/5 $95 and** ***Microsoft Excel 4.0 for Windows Competitive Upgrade*** **SB0243/5 $119.**
Publisher: Microsoft

Excel 4.0 for Windows
BS3253/5

$299



★Presentation Task Force CGM clip art 4.0

Now you can own the clip art *PC Magazine* recently called ..."The best CGM clip art package for overall quality and usability." Presentation Task Force 4.0 is the only clip art product to feature over 3,500 high quality, color illustrations in one value packed, comprehensive volume! Use PTF clip art to enhance presentations, newsletters, and spreadsheets created with over 60 leading DOS and Windows applications, including CorelDraw!, Designer, Harvard Graphics, Microsoft Publisher, PageMaker, Persuasion, PowerPoint, Quattro Pro, Ventura Publisher, Word for Windows, WordPerfect, and many more! PTF 4.0 contains people, animals, business symbols, medical illustrations, holidays, sports, military, and environment-related images.
Publisher: New Vision Technologies, Inc. GR3174

$134

Leading Edge VGA Color System D3/SX Plus 386-20

The Leading Edge Super VGA system uses a 20 MHz 80386SX chip, and has 2 MB of RAM, plus both 3.5" and 5.25" floppy drives and a 130 MB hard disk. It comes complete with a 39mm VGA color monitor, a full 101-key keyboard, and a mouse. Includes MS-DOS 5.0, BASIC, Microsoft Works for Windows and Windows 3.0, Virusscan and the PRODIGY Service start-up kit. Manufacturer's 12-month On-Site Warranty. **Manufacturer: Leading Edge**
BN1060

$1099

CIRCLE 225 ON READER SERVICE CARD

IF YOU WANT THE LATEST IN WINDOWS WORD PROCESSING, WE'LL TAKE YOUR WORD FOR IT. WordPerfect® for Windows combines all the power of the world's most popular word processor and all the ease of Windows. Which is why it won major industry awards and sold more than a million copies in its first seven months. Now with drag and drop text, DDE, zoom edit and more, WordPerfect for Windows is even more powerful. And our $129 offer makes it easy for owners of MS Word and other word processors to trade up. See your participating software reseller for details, or call (800) 526-2635. But hurry. This offer ends December 31, 1992.

WordPerfect®

appropriate mode (IBM mode for signals through the parallel port and Digital PPL mode for serial signals). This handy feature is, of course, valuable only in a mixed environment.

On PC Labs' Text Speed test in quality mode, the LA 75 Plus scored a respectable 63 characters per second. Graphics were rather slow (0.5 graphics pages per minute), but they were certainly worth waiting for, with clear, evenly printed lines and dots.

With its reasonable price, the LA 75 Plus is suited both to offices with a mixture of Digital's systems and PCs or to offices with only PCs.

LA 424 MULTIPRINTER

The LA 424 MultiPrinter improves on the LA 75 Plus by offering a wide carriage and faster printing.

The LA 424 tested at an impressive 178 cps in draft mode and 97 cps in quality mode (IBM emulation), taking second place in text-printing speed for 24-pin printers.

Its graphics output was not as fine as that created by the LA 75 Plus but was still decent.

High-speed printing makes the LA 424 an excellent choice for a mixed Digital and PC environment with moderate-volume printing, but its price may limit it to offices with both Digital computers and PCs.

Digital Equipment Corp., *146 Main St., Maynard, MA 01754-2571; 800-344-4825, 508-493-5111; fax, 800-234-2298.*

DEC LA 75 Plus Companion Printer *List price: $549. additional font cartridges, $50 each; 75-sheet single-bin cut-sheet feeder, $250; paper catcher, $16; six black multistrike ribbons, $30; six color ribbons, $15; acoustic cover, $138; printer stand, $41. Dimensions (HWD): 14.5 x 17 x 5.3 inches. Weight: 23 pounds. Emulations: Digital PPL, IBM Proprinter.*

DEC LA 424 MultiPrinter *List price: $1,349. additional font cartridges, $50 each; 600-sheet triple-bin cut-sheet feeder, $795; six black multistrike ribbons, $60; six color multistrike ribbons, $80; printer stands, $69 and $199; parallel cable, $19. Dimensions (HWD): 14.5 x 17.5 x 12 inches. Weight: 31.5 pounds. Emulations: Digital PPL, IBM Graphics Printer, IBM Proprinter.*

Circle 518 on reader service card

Epson America Inc.

Epson ActionPrinter 3250

BY WINN L. ROSCH

The $299 Epson ActionPrinter 3250 brings together cut-sheet feeding and sharp 24-pin text output but leaves out speed. This is exactly the trade-off you would expect for a printer that sells for around $230 on the street.

The narrow-carriage ActionPrinter expands the bottom end of the Epson line. Its novel feature is a built-in tray for 50 cut sheets. The tray slides out the front of the machine for quick loading. Individual sheets pass to the back, around the rubber platen, and out a slot at the top rear of the thin plastic case.

The unit's controls are minimal: two push buttons and two LED indicators. One button selects one of six resident fonts; the other initiates a form-feed. Pressing both buttons parks continuous-form paper; an optional push tractor for such paper costs $49.

SCALING AWAY

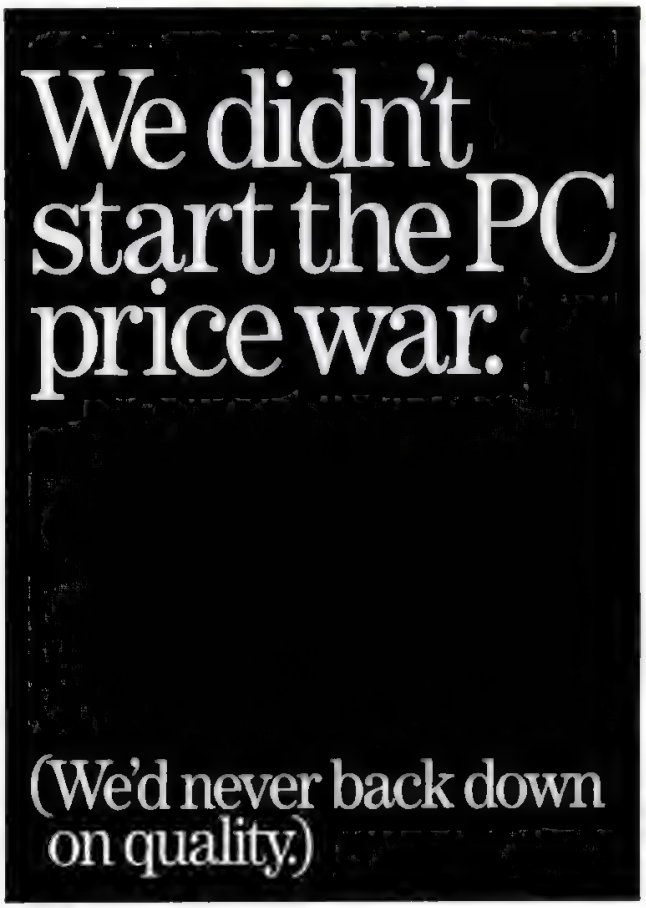
The ActionPrinter's Times Roman and sans serif typefaces are scalable, from 8 to 32 points. Although last year's Epson models had problems accessing the internal scalable fonts in Microsoft Windows, the ActionPrinter does not. The text quality of this 360-dpi printer is excellent for an impact printer, even in draft mode. Its graphics, however, exhibit banding and grayed blacks.

On PC Magazine Labs' Text Speed test, the ActionPrinter was the second-slowest of the 24-pin printers (beating only the portable Tandy DMP 310 Slimline Printer), with scores of 49 characters per second in draft mode and 33 cps in quality mode (IBM emulation). The ActionPrinter could not complete our Page Eject test; it did not respond to a software form feed. Epson could not resolve the problem.

The ActionPrinter has a 14.8- by 9.8-inch footprint, and you can stand the machine on its front end, which reduces its required real estate to 14.8 by 5.1 inches.

Setup is easy, but there is inadequate protection against inserting the ribbon cartridge upside down, an occurrence that destroyed the ribbon during testing and could injure the printhead.

Epson ActionPrinter 3250



If you value print quality over speed, and if you need only occasional output in a light-duty environment, the Epson ActionPrinter 3250 ranks as a clever low-priced offering.

Epson America Inc., *20770 Madrona Ave., Torrance, CA 90509; 800-298-3776, 800-922-8911; fax, 310-782-4248.*

Epson ActionPrinter 3250 *List price: $299; push tractor, $49; black ribbon, $9.95. Dimensions (HWD): 5.1 x 14.8 x 9.8 inches. Weight: 12 pounds. Emulations: Epson ESC/P2, Epson LQ.*
Circle 519 on reader service card

Fujitsu Computer Products of America Inc.

Fujitsu DL1200 PC PrintPartner
Fujitsu DL5800 Power PrintPartner

BY BRUCE BROWN

The two newest dot matrix printers from Fujitsu Computer Products of America—the $649 Fujitsu DL1200 PC PrintPartner and the $1,995 Fujitsu DL5800 Power PrintPartner—fit the company's pattern of selling wide-carriage 24-pin printers geared for moderate to heavy use. Both are sturdy units with excellent text print quality. The small-footprint DL1200 is good for moderate-duty applications, and the DL5800 delivers top speed and flexible paper handling.

Among the features the two printers (which handle 360 by 360 dots per inch) have in common are a 32K buffer and built-in Epson LQ series and IBM Proprinter emulations. In IBM mode, they produced graphics samples with some jagged edges and horizontal banding; their Epson mode graphics were better. Printer emulation cartridges—Diablo 630, Digital LA/50/75/120/210, or Fujitsu DPL24C+—cost $129 each. The units have three built-in fonts; seven optional font cartridges cost $50 to $145.

Both the Fujitsu DL1200 and Fujitsu DL5800 are sturdy units with excellent text print quality.

The best way to handle the setup for both printers is through Fujitsu's DL-MENU TSR.

FUJITSU DL1200 PC PRINTPARTNER

The DL1200, which sells for $400 to $450 on the street, measures 8 by 21 by 10 inches—taller but much less deep than most dot matrix printers. A rear L-feed paper path handles continuous-form paper. Built-in wire legs unfold to let you stack media directly below the printer. You can feed single cut sheets from the top or use an optional $226 80-sheet single-bin cut-sheet feeder.

On our Text Speed test in quality mode, the printer scored a reasonable 48 characters per second in both emulations. (Draft and high-speed draft modes are also available.) Its performance on our Graphics Speed test, however, was among the slowest of the 24-pin printers: 0.6 graphics pages per minute in Epson emulation. And the DL1200 delivered the slowest score on the Direct Print version of our CorelDRAW test.

A fairly easy-to-install $60 color option produced reasonable color. Available printer setup software lets you change and store user settings. The Fujitsu DL1200 PrintPartner is a fine medium-duty system that doesn't take up much desk space.

FUJITSU DL5800 POWER PRINTPARTNER

The high-end Fujitsu DL5800 Power PrintPartner (which has a street price of around $1,500) was the fastest text printer of the 24-pin units reviewed.

The DL5800 zipped through PC Magazine Labs' Text Speed test, with results of 213 cps in draft mode (Epson emulation) and 118 cps in quality mode (both emulations). It was also the fastest on our Word for Windows test.

Rear and bottom paper paths accommodate a variety of paper-handling options, including a $160 pull tractor (which works best with the $80 front-feed adapter) and an assortment of cut-sheet feeders. The basic sheet feeder is a $315 160-sheet single-bin unit, to which you

We didn't start the PC price war.

(Price isn't everything.)

Fujitsu DL1200 PC PrintPartner, Fujitsu DL5800 Power PrintPartner

can add one or two extra 100-sheet bins for $175 each.

The control panel, with its 48-character LCD menu, lets you select typefaces, fonts, and foreign-language character sets.

If you're looking for top speed and excellent paper handling for heavy-duty use, take a look at the Fujitsu DL5800 Power PrintPartner.

Fujitsu Computer Products of America Inc., *2904 Orchard Pkwy., San Jose, CA 95134; 800-626-4686, 408-432-6333; fax, 408-894-3606.*

Fujitsu DL1200 PC PrintPartner *List price: $649; 80-sheet single-bin cut-sheet feeder, $226; font cartridges, $50 to $145 each; Fujitsu DPL24C+, Diablo 630, and Digital LA 50/75/120/210 emulation cartridges, $129 each; color option, $60; black multistrike ribbon, $8.99; color multistrike ribbon, $11.99; serial interface, $74. Dimensions (HWD): 8 x 21 x 10 inches. Weight: 15.4 pounds. Emulations: Epson LQ, IBM Proprinter.*

EDITORS' CHOICE ▶ Fujitsu DL-5800 Power PrintPartner *List price: $1,995; font cartridges, $50 to $145; Fujitsu DPL24C+, Diablo 630, and Digital LA 50/75/120/210 emulation cartridges, $129 each; 160-sheet single-bin cut-sheet feeder, $315; 100-sheet dual-bin cut-sheet feeder, $490; triple-bin cut-sheet feeder (100, 100, and 160 sheets), $665; front-feed adapter, $80; pull tractor, $160; black multistrike ribbon, $16; long-life black multistrike ribbon, $30. Dimensions (HWD): 9 x 23.5 x 13.5 inches. Weight: 42 pounds. Emulations: Epson LQ, IBM Proprinter.*
Circle 520 on reader service card

Genicom Corp.

Genicom 4440 XT

BY JOSEPH DESPOSITO

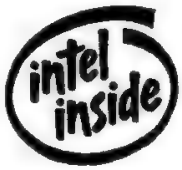
For heavy-duty text printing, Genicom Corp.'s $7,795 Genicom 4440 XT is an attractive deal. Classified as a spring-shuttle printer, it uses three print modules with 22 hammers each—a total of 66 hammers across its wide carriage.

The 4440 XT comes with 2K of RAM, four built-in typefaces, and 13 bar codes, including U.S. Post Office–certified Postnet codes. An optional $83 character generator chip lets you create special symbols of any design and size. The 4440 XT emulates the IBM Proprinter and Prin-

We didn't start the PC price war.

(This is where we draw the line.)

Now we'
the shot



486N Specifications • 32-bit Intel SX, DX and DX2 processors at 25, 33, 50 and 66 MHz. • 4 MB RAM, expandable to 48 MB • Local bus integrated Ultra VGA+ Video with graphics accelerators • 85-430 MB hard drive • 3.5" floppy drive • Three 16-bit expansion slots • ROM-based internal diagnostic and system guide • Integrated Flash BIOS and boot-ROM • Multilevel hardware security • Chip-upgradable

*Suggested U.S. list prices for HP 486/25N and HP 486/33N Model 1 PCs. †Press 1 for HP First, reference Document ID 6310, 6311, 6313. Microsoft is a U.S. registered trademark of Microsoft Corporation. Windows 3.1 is a product of Microsoft Corporation. The Intel Inside logo is a U.S. trademark of Intel Corporation. © 1992 Hewlett-Packard Company PPG-656

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HEWLETT PACKARD

▶ SUMMARY OF FEATURES

Dot Matrix Printers

Products listed in alphabetical order

■ = YES □ = NO

	AMT Accel-212	AMT Accel-214	AMT Accel-242	AMT Accel-244	AMT Accel-292	AMT Accel-294
List price	$469.00	$529.00	$529.00	$595.00	$795.00	$895.00
Physical Characteristics						
Carriage size	Narrow	Wide	Narrow	Wide	Narrow	Wide
Number of pins or hammers	9	9	24	24	Dual-head 9-pin	Dual-head 9-pin
Maximum resolution (dpi)	240 x 216	240 x 216	360 x 360	360 x 360	240 x 216	240 x 216
Color capability	□	□	□	□	□	□
Memory	8K	8K	8K	8K	8K	8K
Parallel/serial interface	■■	■■	■■	■■	■■	■■
Printer-specific Microsoft Windows 3.1 driver available	□	□	□	□	□	□
Paper Handling						
Rated maximum paper weight (pounds)	24	24	24	24	24	24
Paper feeds:						
Pressure	■	■	■	■	■	■
Tractor	■	■	■	■	■	■
Internal	■	■	■	■	■	■
External	■	■	■	■	■	■
Push	■	■	■	■	■	■
Pull	■	■	■	■	■	■
Paper paths:	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U
Tear-off space (inches)	None	None	None	None	None	None
Resident Typefaces						
Courier	□	□	■	■	□	□
Gothic	□	□	□	□	□	□
Line printer	■	■	■	■	■	■
OCR-A/OCR-B	□□	□□	□■	□■	□□	□□
Orator	□	□	■	■	□	□
Prestige Elite	□	□	■	■	□	□
Sans serif	■	■	■	■	■	■
Script	□	□	■	■	□	□
Times Roman	■	■	■	■	■	■
Supports scalable fonts	□	□	□	□	□	□
Postnet bar codes	Optional	Optional	Optional	Optional	Optional	Optional
Rated Noise Level						
Standard mode, quiet mode (dB)	55, N/A	55, N/A	55, 53	55, 53	57, N/A	57, N/A
Control Panel						
Number of LCD characters	16	16	16	16	16	16
Control panel buttons:						
Emulations	■	■	■	■	■	■
Form feed/line feed	■■	■■	■■	■■	■■	■■
Paper parking	■	■	■	■	■	■
Print mode	■	■	■	■	■	■
Typeface selection	■	■	■	■	■	■
Customer Support						
Toll-free technical support	■	■	■	■	■	■
Telephone support hours (eastern time)	9:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F	9:00–8:00 M–F
BBS	□	□	□	□	□	□
Warranty coverage (parts and labor)	1 year	1 year	1 year	1 year	1 year	1 year

N/A—Not applicable: The product does not have this feature

Dot Matrix

ALPS DMX800	Axonix MilWrite	Brother M-4309A	C. Itoh ProWriter C-610II Document Printer	C. Itoh ProWriter C-615II Document Printer (PC Editors' Choice)	Citizen GSX-240	Dataproducts LX 455	DEC LA 75 Plus Companion Printer	DEC LA 424 MultiPrinter
$2,195.00	$1,395.00	$2,195.00	$799.00	$1,175.00	$519.00	$4,595.00	$549.00	$1,349.00
Wide	Narrow	Wide	Narrow	Wide	Narrow	Wide	Narrow	Wide
18	9	18	24	24	24	33	24	24
240 x 216	240 x 216	240 x 216	360 x 360	360 x 360	360 x 360	120 x 144	360 x 180	360 x 180
■	□	■	□	□	Optional	□	■	■
128K	8K	96K	26K	26K	8K	12K	8K	8K
■■	■ Optional	■■	■■	■■	■ Optional	■■	■■	■■
□	□	□	□	□ (included)	■	□ (included)	■ (included)	■
22	21	27	35	35	26	120	24	24
■	■	■	■	■	■	□	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
Optional	□	Optional	□	□	■	□	□	□
■	■	■	■	■	■	■	■	■
Optional	□	Optional	□	□	■	■	■	□
Bottom vertical, rear L, rear U	Rear L, rear U	Bottom vertical, rear L, rear U	Straight-through	Straight-through	Bottom vertical, rear L, top U	Bottom vertical	Bottom vertical, rear U	Bottom vertical, rear U
None	1	0.25	None	None	None	None	None	None
■	■	■	■	■	■	■	■	■
■	■	■	□	□	□	■	□	□
□	□	■	□	□	■	□	□	□
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57, 55	55, 50	57, 55	58, 55	58, 55	47, 43	55, N/A	53, 51	56, 53
32	N/A	32	16	16	9	32	N/A	16
■	□	■	■	■	■	■	□	□
■■	□□	■■	■■	■■	□□	■■	■■	■■
■	■	■	■	■	■	□	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	□	■
■	■	■	■	■	□	■	■	■
10:30–8:00 M–F	10:00–7:00 M–F	9:00–4:30 M–F	11:30–8:00 M–F	11:30–8:00 M–F	11:00–8:00 M–F	11:00–8:00 M–F	7:30–8:00 M–F	8:30–6:00 M–F
□	□	■	■	■	■	■	□	□
1 year	2 years	1 year	2 years	2 years	2 years	1 year	1 year	1 year

CONTINUES

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Epson ActionPrinter 3250	Fujitsu DL1200 PC PrintPartner	Fujitsu DL5800 Power PrintPartner (PC EDITORS' CHOICE)	Genicom 4440 XT	Mannesmann Tally MT150/9	Mannesmann Tally MT150/24
List price	$299.00	$649.00	$1,995.00	$7,795.00	$699.00	$899.00
Physical Characteristics						
Carriage size	Narrow	Wide	Wide	Wide	Narrow	Narrow
Number of pins or hammers	24	24	24	66	9	24
Maximum resolution (dpi)	360 x 360	360 x 360	360 x 360	140 x 144	240 x 216	360 x 360
Color capability	□	Optional	□	□	□	□
Memory	11K	32K	32K	2K	10K	24K
Parallel/serial interface	■□	■ Optional	■■	■■	■ Optional	■ Optional
Printer-specific Microsoft Windows 3.1 driver available	■ (in Windows)	■ (included)	■ (via BBS)	□	□	□
Paper Handling						
Rated maximum paper weight (pounds)	24	22	22	100	24	24
Paper feeds:						
Pressure	■	■	■	□	■	■
Tractor	■	■	■	■	■	■
Internal	Optional	■	■	■	■	■
External	□	□	Optional	□	□	□
Push	Optional	■	■	■	■	■
Pull	□	■	Optional	■	Optional	Optional
Paper paths:	Bottom straight, bottom vertical, front L, rear L	Rear L path, top U	Bottom vertical, rear U	Bottom vertical	Bottom vertical, front L (optional), rear U	Bottom vertical, front L (optional), rear U
Tear-off space (inches)	None	None	None	7	None	None
Resident Typefaces						
Courier	■	■	■	■	■	■
Gothic	□	□	□	■	□	□
Line printer	■	□	□	□	■	■
OCR-A/OCR-B	□□	□□	□□	■■	□□	■■
Orator	□	□	□	□	□	□
Prestige Elite	■	■	■	□	□	■
Sans serif	■	□	□	□	■	■
Script	■	□	□	□	□	■
Times Roman	■	□	□	□	□	■
Supports scalable fonts	■	□	□	□	□	□
Postnet bar codes	□	□	□	■	□	□
Rated Noise Level						
Standard mode, quiet mode (dB)	50, N/A	52, N/A	55, N/A	55, N/A	53, N/A	53, N/A
Control Panel						
Number of LCD characters	N/A	N/A	48	N/A	32	32
Control panel buttons:						
Emulations	□	■	□	■	■	■
Form feed/line feed	■■	■■	■□	■■	□□	□□
Paper parking	■	■	■	□	■	■
Print mode	■	■	■	■	■	■
Typeface selection	■	■	■	■	■	■
Customer Support						
Toll-free technical support	■	■	■	■	□	□
Telephone support hours (eastern time)	8:00 A.M.–11:00 P.M. M–F	10:00–8:00 M–F	10:00–8:00 M–F	8:00–7:00 M–F	10:30–7:30 M–F (dealers only)	10:30–7:30 M–F (dealers only)
BBS	■	■	■	■	■ (dealers only)	■ (dealers only)
Warranty coverage (parts and labor)	2 years	2 years	1 year	3 months	1 year	1 year

N/A—Not applicable The product does not have this feature

Mannesmann Tally MT151/9	Mannesmann Tally MT151/24	Okidata Microline 184 Turbo	Okidata Pacemark 3410	OTC Euroline 400	PC EDITORS' CHOICE OTC Euroline 600	Panasonic KX-P2123	PC EDITORS' CHOICE Panasonic KX-P2124	Panasonic KX-P2180
$749.00	$949.00	$359.00	$1,999.00	$5,495.00	$6,995.00	$419.95	$549.95	$299.95
Wide	Wide	Narrow	Wide	Wide	Wide	Narrow	Narrow	Narrow
9	24	9	9	Dual-head 21 pin	Triple-head 21-pin	24	24	9
240 x 216	360 x 360	240 x 216	240 x 216	240 x 216	240 x 216	360 x 360	360 x 360	240x216
□	□	□	□	□	□	Optional	Optional	Optional
10K	24K	2K	64K	7.8K	7.8K	14K	20K	4K
■ Optional	■ Optional	■ Optional	■■	■■	■■	■ Optional	■ Optional	■ Optional
□	□	■ (included)	■ (included)	□	□	■ (via BBS)	■ (via BBS)	■ (via BBS)
24	24	24	24	120	120	24	24	24
■	■	■	■	□	□	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
□	□	Optional	Optional	□	□	□	□	□
■	■	■	■	□	□	■	■	■
Optional	Optional	Optional	Optional	■	■	■	■	■
Bottom vertical, front L (optional), rear U	Bottom vertical, front L (optional), rear U	Bottom vertical, rear U, top feed	Bottom vertical,	Bottom vertical	Bottom vertical rear U, top feed	Bottom vertical, rear U, top feed	Bottom vertical, rear U, top feed	Bottom vertical, rear U, top feed
None	None	1	None	None	None	None	None	None
■	■	□	■	□	□	■	■	■
□	□	□	■	□	□	□	□	□
■	■	■	■	■	■	□	□	□
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□	□	□	□	□	□	□	□	□
□	□	□	■	■	■	□	□	□
53, N/A	53, N/A	55, N/A	58, N/A	53, 48	53, 48	47, 44	47, 44	48, 45
32	32	N/A	N/A	32	32	N/A	16	N/A
■	■	□	□	■	■	■	■	■
□□	□□	■■	■■	■■	■■	■■	■■	■■
■	■	□	■	□	□	■	■	■
■	■	■	■	■	■	■	■	■
■	■	□	□	■	■	■	■	■
□	□	■	■	■	■	■	■	■
10:30–7:30 M–F (dealers only)	10:30–7:30 M–F (dealers only)	8:00–6:00 M–F	8:00–6:00 M–F	12:30A.M.–11:30 P.M. M–F	12:30A.M.–11:30 P.M. M–F	9:00–5:00 M–F	9:00–5:00 M–F	9:00–5:00 M–F
■ (dealers only)	■ (dealers only)	■	■	■	■	■	■	■
1 year	1 year	1 year	1 year	1 year	1 year	2 years	2 years	2 years

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CIRCLE 363 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Seikosha SP-2400	Seikosha SP-2415	PC EDITORS' CHOICE Star NX-2430 Multi-Font	Tandy DMP 310 Slimline Printer	PC EDITORS' CHOICE Unisys AP 1371
List price	$329.00	$549.00	$399.00	$399.95	$3,295.00
Physical Characteristics					
Carriage size	Narrow	Wide	Narrow	Narrow	Wide
Number of pins or hammers	9	9	24	24	18
Maximum resolution (dpi)	240 x 216	240 x 216	360 x 360	360 x 180	240 x 144
Color capability	□	□	□	□	■
Memory	1K	17K	16K	11K	32K
Parallel/serial interface	■□	■■	■ Optional	■□	■■
Printer-specific Microsoft Windows 3.1 driver available	□	□	□*	□	■ (in Windows)
Paper Handling					
Rated maximum paper weight (pounds)	21	21	24	21	32
Paper feeds:					
Pressure	■	■	■	■	■
Tractor	■	■	■	□	■
Internal	■	■	■	□	Optional
External	□	□	Optional	□	Optional
Push	■	■	■	□	Optional
Pull	□	□	Optional	□	□
Paper paths:	Rear U, top feed	Rear U, top feed	Bottom vertical, rear U	Straight-through	Bottom vertical, front L, rear L, rear U
Tear-off space (inches)	1	1	None	None	None
Resident Typefaces					
Courier	■	■	■	■	■
Gothic	■	■	□	□	□
Line printer	□	□	□	■	□
OCR-A/OCR-B	□□	□□	□□	□□	□■
Orator	□	□	□	□	□
Prestige Elite	■	■	■	□	□
Sans serif	■	■	■	□	■
Script	■	■	■	□	□
Times Roman	□	□	■	□	□
Supports scalable fonts	□	□	□	□	□
Postnet bar codes	□	□	□	□	■
Rated Noise Level					
Standard mode, quiet mode (dB)	56, 55	57, 55	54, 51	57, 55	Less than 55, 51
Control Panel					
Number of LCD characters	N/A	N/A	130	N/A	80
Control panel buttons:					
Emulations	□	□	■	□	■
Form feed/line feed	■■	■■	□□	□□	■■
Paper parking	■	■	■	□	■
Print mode	■	■	■	□	■
Typeface selection	■	■	■	□	■
Customer Support					
Toll-free technical support	■	■	□	□	■
Telephone support hours (eastern time)	9:00–5:00 M–F	9:00–5:00 M–F	10:00–6:00 M, 9:00–6:00 T–F	N/A	24 hours a day, M–F
BBS	□	□	■	N/A	■
Warranty coverage (parts and labor)	2 years	2 years	2 years	1 years	1 years

* The Microsoft Windows 3.1 driver was not available for testing, but the company says it is now shipping. N/A—Not applicable. The product does not have this feature.

ENDS

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CIRCLE 101 ON READER SERVICE CARD

tronix P-series printers and is plug-compatible with the Printronix family of shuttle printers.

The printer has two control panels: one on the top cover of the cabinet (for frequently used controls) and another inside (for all controls). The control panel lets you configure certain features through "printer control straps." This confusing nomenclature simply means you can set parameters on or off by entering a 0 or 1 through the panel. Once you get the hang of them, the control panels are easy to operate.

Genicom 4440 XT

Upper and lower tractor feeds provide several ways to align forms easily: through a notch on the tractor, on-the-fly, or "see 'n set." You can store up to ten configuration settings.

To set up the 285-pound 4440 XT, you must remove six packing bolts (a few are tough to reach). The printer uses an easily installed re-inking ribbon rated at an impressive 75 million characters.

The 4440 XT did well on the wide-carriage Text Speed test: In draft mode, it scored 425 lines per minute (second-fastest of the line printers). It also placed second on the narrow-carriage test in quality mode, with 127 lpm (IBM emulation), but slipped to last place in its category on the narrow-carriage test in draft mode, with only 326 lpm (IBM emulation). It was the slowest of the four in the line printer class on our Graphics Speed test—0.6 graphics pages per minute.

The printer, which handles 140 by 144 dpi, produced average text output, but obtaining graphics of reasonable quality proved difficult. With a new ribbon, you will need to print around 100 pages before graphics quality becomes acceptable; at first, expect smudging and poor contrast.

Genicom sells mostly to distributors, and VARs, but you may find discounts on quantity buys. Fast draft printing in wide-carriage mode and built-in features like bar codes make the 4440 XT a worthy choice for heavy-duty processing.

Genicom Corp., *One Genicom Dr., Waynesboro, VA 22980-1999; 800-443-6426; fax, 703-949-1392.*

Genicom 4440 XT *List price: $7,795. Character generator chip, $83; black ribbon, $42; black multistrike ribbon, $55.56; paper motion detector, $71; bar code and label graphics controller, $21.53. Dimensions (HWD): 48.2 x 29.2 x 25.7 inches. Weight: 285 pounds. Emulations: IBM Proprinter, Printronix P800/600.*

Circle 521 on reader service card

Mannesmann Tally Corp.

Mannesmann Tally MT150/9
Mannesmann Tally MT150/24
Mannesmann Tally MT151/9
Mannesmann Tally MT151/24

BY JOSEPH DESPOSITO

Mannesmann Tally Corp.'s four dot matrix printers—the 9-pin $699 MT150/9 and $749 MT151/9, and the 24-pin $899 MT150/24 and $949 MT151/24—are bound by a common thread, called the workload. All are rated at an impressive capacity of up to 9,500 pages per month and offer solid performance. For a little extra, the 24-pin units offer more flexibility and faster printing.

All four printers share a common design, which includes a built-in single-sheet feeder that works well. But during testing, paper jammed in the standard rear tractor feeds several times.

Each printer uses a 32-character LCD panel to control all printer functions (even loading paper). The control panel is easy to learn, and it offers convenient paper-handling features such as tearing, viewing, and paper parking.

Options include a 150-sheet single-bin cut-sheet feeder, which installs easily on top of the printers. This costs $149 for the narrow-carriage printers; a second 150-sheet bin for the narrow-carriage printers costs $109. (Wide-carriage versions of these paper-handling options sell for about $5 more per item.) A pull tractor ($50 and $54 for narrow- and wide-carriage systems, respectively) is needed for multipart forms and uses the bottom-feed path. A roll-paper holder for the narrow-carriage printers costs only $55.

For all four printers, color capability adds $100 to the list price, but you have to order the printer that way; an upgrade kit is not available.

Standard emulations on all four are Epson (FX for the 9-pin printers and LQ for the 24-pin models), IBM Proprinter, and Mannesmann Tally Printer Language. An upcoming DEC LA 75 emulation had not been priced at press time.

In draft mode, the four produced similar scores on the Text Speed test, from 150 characters per second for the MT150/9 to 159 cps for the MT151/24.

MT150/9 and MT151/9

Mannesmann Tally MT150/9, Mannesmann Tally MT150/24, Mannesmann Tally MT151/9, Mannesmann Tally MT151/24

Both 9-pin models—the narrow-carriage MT150/9 and the wide-carriage MT151/9—offer three typefaces and come with 10K of RAM. (A 128K upgrade for all four printers is expected by the time you read this.) Text and graphics quality of these

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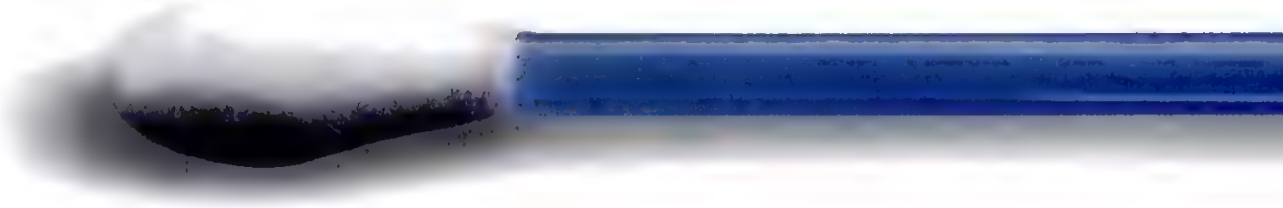

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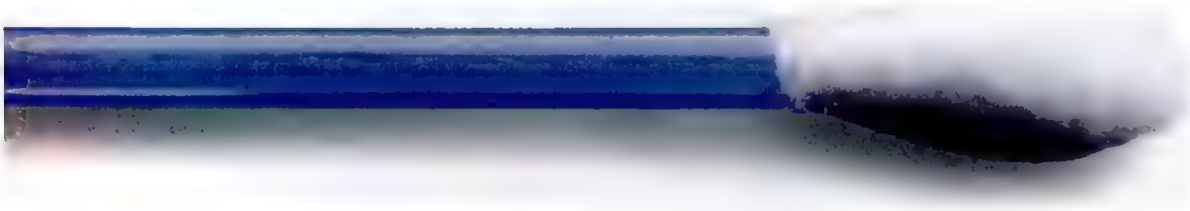

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models, which handle 240 by 216 dots per inch, are average for 9-pin printers.

The MT150/9 and MT151/9 both posted solid, middle-of-the-road numbers on the Text Speed test in quality mode: 46 cps in IBM emulation.

MT150/24 and MT151/24

The 24-pin MT150/24 and its wide-carriage brother, the MT151/24, each have 24K buffers and offer eight fonts. Both 360-by-360-dpi printers produce quality text. Their graphics output, however, was only average for printers of this class.

The MT150/24 and MT151/24 were much faster than both the 9-pin versions and most of the 24-pin competition on the Text Speed test in quality mode: The MT150/24 scored 83 cps and the MT151/24 scored 84 cps (both emulations). They were also among the top scorers on our Windows applications tests.

Both printers blazed through the Graphics Speed test at 2.6 graphics pages per minute—the fastest times of the dot matrix printers tested. But if you print graphics continually, a "Printhead Hot" warning comes up on the control panel and the speed changes to half the normal rate. A built-in fan helps cool the printhead quickly after printing ceases.

The 24-pin MT150/24 and MT151/24 offer more fonts and greater speed for text and graphics printing than do their 9-pin siblings. But apart from occasional paper-jamming problems, all four printers offer a solid mix of features, performance, and price.

Mannesmann Tally Corp., *8301 S. 180th St., P.O. Box 97018, Kent, WA 98064-9718; 800-843-1347, 206-251-5500; fax, 206-251-5520.*

Mannesmann Tally MT150/9 *List price: $699; color model, $799. 150-sheet single-bin cut-sheet feeder, $149; 150-sheet second-bin cut-sheet feeder, $109; roll-paper holder, $55; pull tractor, $50; 1-page front feeder, $40; black ribbon, $10; color ribbon, $12.50; serial interface, $109. Dimensions (HWD): 6.3 x 18 x 13.5 inches. Weight: 20.9 pounds. Emulations: Epson FX, IBM Proprinter, Mannesmann Tally Printer Language.*

Mannesmann Tally MT151/9 *List price: $749; color model, $849. 150-sheet single-bin cut-sheet feeder, $154; 150-sheet second-bin cut-sheet feeder, $114; 1-page front feeder, $44; pull tractor, $54; black ribbon, $13; color ribbon, $16; serial interface, $109. Dimensions (HWD): 5.5 x 23.5 x 13.2 inches. Weight: 25.7 pounds. Emulations: Epson FX, IBM Proprinter, Mannesmann Tally Printer Language.*

Mannesmann Tally MT150/24 *List price: $899; color model, $999. Options are the same as for the MT150/9. Dimensions (HWD): 6.3 x 18 x 13.5 inches. Weight: 19.2 pounds. Emulations: Epson LQ; IBM Proprinter; Mannesmann Tally Printer Language.*

Mannesmann Tally MT151/24 *List price: $949; color model, $1,049. Options are the same as for the MT151/9. Dimensions (HWD): 5.5 x 23.5 x 13.2 inches. Weight: 24 pounds. Emulations: Epson LQ; IBM Proprinter; Mannesmann Tally Printer Language.*

Circle 522 on reader service card

Okidata

Okidata Microline 184 Turbo
Okidata Pacemark 3410

BY BRUCE BROWN

Okidata, a long-time major player in the printer market, has two new 9-pin products: the $359 narrow-carriage Okidata Microline 184 Turbo and the $1,999 wide-carriage Okidata Pacemark 3410. The no-frills Microline is best for industrial applications; the high-speed, heavy-duty Pacemark is built for high-production needs.

Okidata Microline 184 Turbo, Okidata Pacemark 3410

The Microline has one line-printer font in four print modes: super-speed draft (a sparse print matrix), draft, utility, and NLQ. No other internal fonts or optional font cartridges exist; if you want other fonts, you have to download them. The Pacemark provides Courier and Gothic fonts in the same four print modes and adds eight resident bar code styles, including Postnet codes. Both units, which handle 240 by 216 dpi, produced text and graphics output typical for 9-pin printers, though the Pacemark's NLQ print quality is more impressive.

MICROLINE 184 TURBO

The Microline 184 Turbo (with a $215 street price) replaces the Microline as the lowest priced of Okidata's eight dot matrix printers. Intended for industrial applications, this printer is too noisy for home use, especially when printing graphics; it is also too limited for general office use.

The Microline comes standard with a 2K buffer and a parallel port. A high-speed serial interface costs $90, and an optional pull tractor for bottom-feeding forms costs $50. A roll-paper holder sells for $33. When you buy the Microline, you must choose a single emulation: either IBM Graphics Printer–compatible (used for testing) or Okidata Microline mode.

On our Text Speed test in quality mode, the gear-driven Microline produced an acceptable 47 characters per second. But on the Graphics Speed test, it scored a laggardly 0.5 graphics pages per minute, among the slowest of this roundup. It also did poorly on our Windows applications tests. During the Graphics Speed test, the printer's noise was particularly noticeable.

An extended warranty that includes on-site service is available through TRW ($164 per year). The Microline is fine for use in a factory or anyplace where text printing—not noise control—is the priority.

PACEMARK 3410

The $1,999 Pacemark 3410, updating the venerated Pacemark, takes over the top of the company's dot matrix line. The new Pacemark (whose street price is around $1,299) proved one of the fastest 9-pin printers we tested. It comes with a standard 64K buffer and Epson FX, IBM Graphics Printer, and IBM Proprinter emulations (a Pacemark emula-

tion chip costs $50). With a 16-bit 12-MHz processor, a big buffer, and fast paper advance, the Pacemark produced 226 cps on our Text Speed test in draft mode. In quality mode, it managed 92 cps (Epson emulation). Its graphics result was an impressive 2.2 gppm in Epson mode. The Pacemark also scored well on our Windows applications tests.

An internal push tractor comes standard; an optional $79 pull tractor lets you vertically feed multipart forms through the printer's bottom paper slot. An optional single-bin cut-sheet feeder ($399) holds 130 sheets; a $699 dual-bin sheet-feeder handles 130 sheets per bin.

The Pacemark's standard one-year warranty has a bonus of on-site service via TRW for the first 90 days. Extended warranties including on-site service cost a reasonable $200 per year, a good idea if you put this printer to the rugged use for which it was built.

Okidata, *532 Fellowship Rd., Mount Laurel, NJ 08054; 800-654-3282, 609-235-2600; fax, 609-778-4184.*

Okidata Microline 184 Turbo *List price: $359. roll-paper holder, $33; pull tractor, $50; black multistrike ribbon, $9.95; serial interface, $90. Dimensions (HWD): 3.2 x 15 x 14.7 inches. Weight: 10 pounds. Emulations: IBM Graphics Printer or Okidata Microline series.*

Okidata Pacemark 3410 *List price: $1,999. Pacemark 2410 emulation chip, $50; 130-sheet single-bin cut-sheet feeder, $300; 260-sheet dual-bin cut-sheet feeder, $699; pull tractor, $79; black multistrike ribbon, $34.95. Dimensions (HWD): 7.5 x 20 x 19 inches. Weight: 63 pounds. Emulations: Epson FX, IBM Graphics Printer, IBM Proprinter, Okidata Microline series.*

Circle 523 on reader service card

Output Technology Corp.

OTC Euroline 400
OTC Euroline 600

BY WINN L. ROSCH

The more heads, the quicker the printer, according to Output Technology Corp. The company's $5,495 OTC Euroline 400 sports two printheads, and its $6,995 OTC Euroline 600 uses three. Both wide-carriage line printer emulators deliver high-speed, draft-quality output, with the Euroline 600 taking top honors among the line printers for draft text speed.

When a printer has two printheads, each printhead travels only half the distance of a single printhead; with three, only one-third. This should result in a reciprocal acceleration in output speed. Each printhead carries 21 wires. On PC Magazine Labs' Text Speed test in draft mode (which most users will select for this type of printer), the Euroline 600 led the field with 477 lines per minute on the narrow-carriage test and 500 lpm on the wide-carriage test. For narrow-carriage quality-mode testing, it slipped to third place in its category.

OTC Euroline 400, OTC Euroline 600

The Euroline 400 was slower than the single-printhead Dataproducts LX 455 on the narrow-carriage Text Speed test in draft mode, producing 365 lpm to the other's 443 lpm. On the wide-carriage Text Speed test in draft mode, it only narrowly bested the Dataproducts unit, scoring 363 lpm. It was the slowest of the four line printers in quality mode.

Both Eurolines are limited by their resolution of 240 by 216 dots per inch. For applications like zipping out wide-paper reports at high speeds, their lack of built-in typefaces other than line printer won't matter, though an optional $275 cartridge provides OCR-A and OCR-B.

Both do dot-addressable graphics under several emulations, including 9-wire IBM Proprinter and Epson FX. The pair generated decent graphics, but switching between text and graphics modes involved changing the printer-head gaps.

Apart from number of printheads, the two Eurolines share a common design. (Due to a difference in printhead carriages, however, a Euroline 400 cannot be upgraded to a Euroline 600.) Both Euroline machines use stationary metal platens and rely on push-button control for all paper positioning. Continuous-form sheets are pulled past the printhead by a tractor. The menu-driven control system on each consists of a 32-character LCD panel and an array of membrane switches. Configuring the four macros is vexing, but once set, selecting among the settings is easy.

Each Euroline stands 43 inches tall with a 28-by-23-inch footprint and weighs 193 pounds. But they are easy to wheel around on built-in casters. The bulky case is a sound-absorber, reducing the noise to 53 decibels. An $895 acoustic kit muffles sound to 48 dB.

With some media widths other than 16-inch paper, however, a printhead can interfere with opening the pull tractors.

The Euroline 600 (about $5,250 on the street) ranks at the top of the line-printer pack for text speed and sturdy design. The Euroline 400 (roughly $4,120 on the street) rates one notch down for performance but not for mechanical integrity. Output Technology has produced a pair of the most rugged line printer emulators you can buy for fast, draft-quality output.

Output Technology Corp., *2310 N. Sancher Rd., Spokane, WA 99212; 800-468-8788; fax, 509-533-1280.*

OTC Euroline 400 *List price: $5,495; font cartridges, $275 each; black ribbon, $39.95; two black ribbons, $69.90; acoustic kit, $895. Dimensions (HWD): 43 x 28 x 23 inches. Weight: 193 pounds. Emulations: Dataproducts LB series, DEC LA 210; Epson FX; IBM Proprinter; Printronix P-series, Printronix S-series.*

OTC Euroline 600 *List Price: $6,995; font cartridges, $275 each; black ribbon, $39.95; two ribbons, $69.90; acoustic kit, $895. Dimensions (HWD): 43 x 28 x 23 inches. Weight: 193 pounds. Emulations: Dataproducts LB series, DEC LA 210; Epson FX; IBM Proprinter; Printronix P-series, Printronix S-series*

Circle 524 on reader service card

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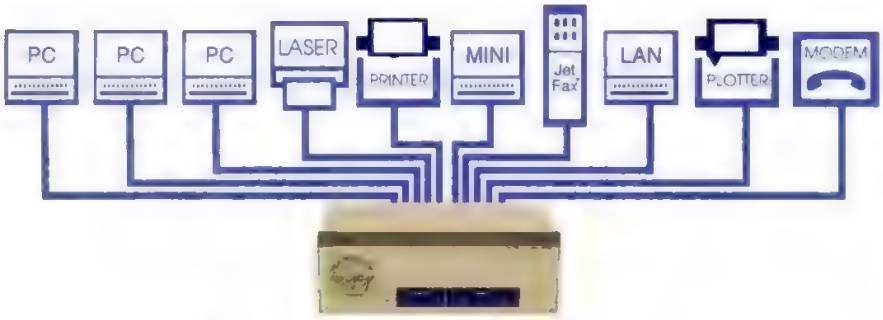

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CIRCLE 328 ON READER SERVICE CARD

Panasonic Communications & Systems Co.

Panasonic KX-P2123
Panasonic KX-P2124
Panasonic KX-P2180

BY BRUCE BROWN

Panasonic Communications & Systems Co. has long sold high-quality dot matrix printers loaded with features. This year's new narrow-carriage units (the $299.95 9-pin Panasonic KX-P2180, $419.95 24-pin Panasonic KX-P2123, and $549.95 24-pin Panasonic KX-P2124) all use a diamond-shaped print matrix for exceptionally quiet operation.

In normal mode, the printers are rated from 46.5 to 48 dB—much lower than their competitors' ratings. A "super" quiet mode (43.5 to 45 decibels) cuts the print speed in half.

Along with quiet printing, all three offer IBM Proprinter and Epson emulations (FX for the KX-P2180 and LQ for the others) and a minimum of five fonts. The KX-P2123 and the KX-P2124 also offer a super-letter-quality option (a denser matrix of the Roman typeface); the KX-P2124 adds Orator and OCR-B. Both 24-pin printers now feature Adobe Type Manager for Windows with 13 scalable typefaces, though this was not available at test time.

All three printers are available with optional $69.95 color kits. Other options include a 32K buffer upgrade ($75), an 80-sheet single-bin cut-sheet feeder ($139.95), and two serial interfaces (9,600 bps for $69.95 and 19.2 Kbps for $109.95). Each includes a parallel interface.

All offer paper parking and paper loading in tractor mode via control-panel buttons, as well as auto-loading in friction mode, dual-mode push or pull tractors, and rear and bottom feeding.

Front control panels let you set all the parameters: the typeface, emulations, print modes, colors, and page-format instructions. You can save one macro with the KX-P2180, two with the KX-P2123, and four with the KX-P2124. The control panel can be complicated to use but works well once you get used to it.

PANASONIC KX-P2180

The KX-P2180, with a standard 4K print buffer, has a street price ranging from $160 to $180. Text and graphics quality of this printer, which handles 240 by 216 dots per inch, represent what a modern 9-pin printer can produce.

This inexpensive unit produced the slowest results of the 9- and 18-pin printers on our Text Speed test: 89 characters per second in draft mode and 27 cps in quality mode (IBM emulation). Even so, its array of features means that you still get a lot of printer for a low street price.

PANASONIC KX-P2123

With a street price of $230, the 24-pin KX-P2123 offers a little more speed than the KX-P2180 does and noticeably better print quality.

Panasonic KX-P2123, Panasonic KX-P2124, Panasonic KX-P2180

The KX-P2123, which has a 14K buffer, produced a reasonable score of 46 cps on our Text Speed test in quality mode (IBM emulation). The text and graphics quality samples for the 360- by 360-dpi KX-P2123 outshine the 9-pin KX-P2180's. Its SLQ and sans serif LQ output is particularly impressive. The color sample, however, had slight red banding in the horizontal color block test.

The better speed and vastly improved print quality of this unit justifies the additional $50 to $70 (after discounts) that you pay over the price of the KX-P2180.

PANASONIC KX-P2124

With an expected street price of $300 and a 20K buffer, the KX-P2124 is a bargain. For one thing, on our Text Speed test in quality mode, the KX-P2124 was appreciably faster than the KX-P2123, with 61 cps (both emulations).

Panasonic's new narrow-carriage printers use a diamond-shaped print matrix for exceptionally quiet operation.

The 360- by 360-dpi KX-P2124's quality output samples also match those of by the KX-P2123, with the exception of the color test: The KX-P2124 did not produce color banding.

With higher speed, more fonts, and a bigger buffer, the KX-P2124 is the best—if slightly more costly—buy of the three.

Panasonic Communications & Systems Co., *Two Panasonic Way, Secaucus, NJ 07904; 800-742-8086, 201-348-7000.*

Panasonic KX-P2180 *List price: $299.95; 32K RAM upgrade, $75; 80-sheet single-bin cut-sheet feeder, $139.95; color option, $69.95; black multistrike ribbon, $12.99; color multistrike ribbon, $24.99; 9,600-bps serial interface, $69.95; 19.2-Kbps serial interface, $109.95. Dimensions (HWD): 5.8 x 18.1 x 14.3 inches. Weight: 19 pounds. Emulations: Epson FX, IBM Proprinter.*

Panasonic KX-P2123 *List price: $419.95; 32K RAM upgrade, $75; 80-sheet single-bin cut-sheet feeder, $139.95; color option, $69.95; black multistrike ribbon, $12.99; color multistrike ribbon, $24.99; 9,600-bps serial interface, $69.95; 19.2-Kbps serial interface, $109.95. Dimensions (HWD): 5.8 x 18.1 x 14.3 inches. Weight: 19 pounds. Emulations: Epson LQ, IBM Proprinter.*

EDITORS' CHOICE ▶ Panasonic KX-P2124 *List price: $549.95; 32K RAM upgrade, $75; 80-sheet single-bin cut-sheet feeder, $139.95; color option, $69.95; black multistrike ribbon, $12.99; color multistrike ribbon, $24.99; 9,600-bps serial interface, $69.95; 19.2-Kbps serial interface, $109.95. Dimensions (HWD): 5.6*

x 16.9 x 14.1 inches. Weight: 18.7 pounds. Emulations: Epson LQ, IBM Proprinter. Circle 525 on reader service card

Seikosha America Inc.

Seikosha SP-2400
Seikosha SP-2415

BY BRUCE BROWN

In addition to low-cost 9-pin printing, Seikosha America's $329 narrow-carriage Seikosha SP-2400 and $549 wide-carriage Seikosha SP-2415 both offer decent text quality. But sluggish performance will limit this pair to light-duty applications.

The SP-2400 and SP-2415 both have membrane-button control panels that are simple to use, mainly because there are few options. The control panels offer separate buttons for form and line feeds, and you can use them to set the typeface and print mode, but there are no user macros to store settings.

Seikosha SP-2400, Seikosha SP-2415

Both printers offer paper parking and automatic paper loading via the control panel. Each has a standard internal push tractor, and a rear paper path for continuous forms and top feeding for single cut sheets.

The SP-2400 and SP-2415 have Epson FX and IBM Proprinter emulations and offer five resident fonts. Their maximum resolution is 240 by 216 dots per inch.

The systems turned out decent text and graphics output for 9-pin printers. The output couldn't pass for laser printing but is fine for casual correspondence.

For this pair of printers, what you get standard is about all you get; the only options are a $9 adjustable printer stand for either and a buffer upgrade for the SP-2400.

SEIKOSHA SP-2400

The Seikosha SP-2400 lists for $329 but typically sells in the low $200 range. The unit, which comes with a parallel interface only, has a standard 1K buffer; this number can be increased to the maximum 22K with an $18 21K upgrade.

The SP-2400 was near the bottom of the pack in speed on our Text Speed test in quality and draft modes: 96 characters per second and 32 cps (IBM emulation), respectively. Its graphics speed was also uninspiring, at 0.7 graphics pages per minute (Epson emulation). Those scores are about even with those of the Axonix MilWrite (reviewed in this issue), an industrial-strength, repackaged portable version of the SP-2400.

SEIKOSHA SP-2415

The $549 SP-2415 is a little more costly than the SP-2400, but with street prices somewhere around $400, this wide-carriage printer still won't break the bank.

The SP-2415 has a standard 17K buffer. On our Text Speed test, the SP-2415 was (like its sibling) among the slowest printers: It achieved 94 cps in draft mode and 31 cps in quality mode. During graphics testing, the SP-2415 pulled in 0.8 gppm in Epson emulation. In IBM mode, the denser test graphics images caused it to slow down, as if the printer were overheated.

The two 9-pin Seikosha printers are simple to use, with decent quality but slow speeds. Those with tight budgets and light printing needs will be happiest with these systems' low prices and tolerant of their plodding output.

Seikosha America Inc., *10 Industrial Ave., Mahwah, NJ 07430; 800-338-2609, 201-327-7227; fax, 201-818-9135.*

Seikosha SP-2400 *List price: $329; 21K RAM upgrade, $18; black multistrike ribbon, $9.50; printer stand, $9. Dimensions (HWD): 4 x 14.8 x 13 inches. Weight: 7.3 pounds. Emulations: Epson FX, IBM Proprinter.*

Seikosha SP-2415 *List price: $549; black multistrike ribbon, $19; printer stand, $9. Dimensions (HWD): 4 x 20.5 x 13 inches. Weight: 9.3 pounds. Emulations: Epson FX, IBM Proprinter. Circle 526 on reader service card*

Star Micronics America Inc.

Star Micronics NX-2430 Multi-Font

BY BRUCE BROWN

If you want ease of use and excellent print quality more than sheer speed, the $399 Star Micronics NX-2430 Multi-Font, from Star Micronics America, is a superb value. This low-cost printer goes for about $250 on the street. While the narrow-carriage 24-pin printer is fairly slow, it has an intuitive control panel and handles paper smoothly.

The distinctive control panel is well marked and easy to use, with a multiline LCD menu and display screen. You can't select print enhancements from the control panel, but you can set just about everything else: the emulation, typeface, pitch, print mode, page formatting, and foreign-language character sets. One user-defined macro can save font, pitch, and paper-feed modes.

The control panel also dictates paper parking. The printer's auto-loading (by pulling the paper bail forward) works for both the rear-U and bottom-vertical paper paths. An optional pull tractor for bottom-feeding forms costs $50. A 50-sheet single-bin cut-sheet feeder ($99) is easy to install and use.

The NX-2430 emulates the Epson LQ and IBM Proprinter. Five resident fonts are available, as well as two draft modes (with a sparser character matrix). Eight cartridges, each costing $39, offer a total of 21 fonts. The printer comes with 16K

Star Micronics NX-2430 Multi-Font

"No matter how much we grow, we know we can bank on the LANtastic networking system."

MIS Manager Nola Matthews and Tracy Schmidt, VP of Operations, First Interstate Bank of South Dakota, N.A.

THE BIG SWITCH
INTERVIEW #5:

LAN TIMES READERS CHOICE 1992

PC MAGAZINE EDITORS' CHOICE April 14, 1992 LANtastic, Version 4.10

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In the summer of 1991, the Credit Card Division of First Interstate Bank of South Dakota needed to network 10 computers. Since they already had an open Novell® license, their first inclination was to go with Novell. But Sandy Silverberg, of **Ideasign Computers**, an Artisoft Authorized Five Star™ dealer, urged them to check out the LANtastic® networking system. Since a neighboring department was running a Novell NetWare® network (v2.15) and another department was running a LANtastic network, comparisons were easy. They chose the LANtastic system and are now up to **100 nodes** – and growing. Why did they choose LANtastic?

"Our primary considerations were the LANtastic system's peer-to-peer capabilities, its ability to interface with our mainframe, the ease of its installation and maintenance and the significant cost-savings over Novell," says Tracy Schmidt, VP of Operations. **"The installation turned out amazingly fast and simple. I left work at 7:00 one evening with no network and when I came in the next morning, our people were already signed on and productive."** Nola Matthews, MIS Manager, says, "The system has been extremely reliable and we have received excellent, unlimited and free technical support from Artisoft. We are using two 3270 gateways, which provide us with up to 80 simultaneous sessions on a mainframe. From its low cost to its reliability to its ease of use, our LANtastic network has proved to be a complete and remarkable package."

Thanks, Tracy, Nola and Sandy. We appreciate your giving us all that credit.

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CIRCLE 254 ON READER SERVICE CARD

of RAM, upgradable to 48K for $49.

The NX-2430 was one of the slower of the 24-pin performers, delivering 45 characters per second in quality mode on PC Magazine Labs' Text Speed test. But print quality for this 360-dot-per-inch printer is excellent, both in text and graphics. Characters were dark and clearly defined.

Unless you have high-production needs that require very fast speeds, you can't go wrong with the $399 Star Micronics NX-2430 Multi-Font. With affordably priced options, ease of use, and high-quality output, this printer has everything except for record-breaking speed.

Star Micronics America Inc., *420 Lexington Ave., #2702, New York, NY 10170; 800-447-4700, 908-572-3300; fax, 212-661-5838.*

EDITORS' CHOICE ▶ Star Micronics NX-2430 Multi-Font *List price: $399; 32K RAM upgrade, $49; font cartridges, $39 each; 50-sheet single-bin cut-sheet-feeder, $99; pull tractor, $50; black multistrike ribbon, $9.50; high-capacity black multistrike ribbon, $13.95; serial interface converter cable, $85. Dimensions (HWD): 6.5 x 17.3 x 15.5 inches. Weight: 14.1 pounds. Emulations: Epson LQ, IBM Proprinter. Circle 527 on reader service card*

Tandy Corp.

Tandy DMP 310 Slimline Printer

BY JOSEPH DESPOSITO

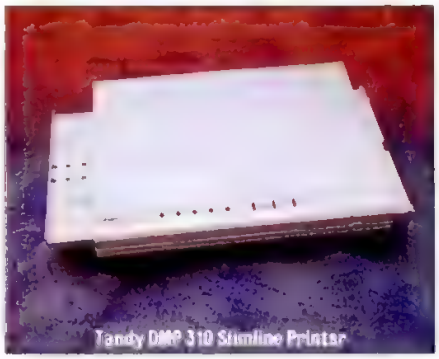
For a portable dot matrix printer, the $399.95 24-pin Tandy DMP 310 Slimline Printer, from Tandy Corp., offers decent print quality at a reasonable price. And though it isn't up to desktop printer speed, the DMP 310 moves along at an acceptable pace for a portable.

The DMP 310 is manufactured to the specs of the Seikosha LT 20 (reviewed in last year's annual printer issue), with some minor changes to make it compatible with other Tandy products. It also adds a native emulation to the IBM Proprinter emulation.

Tandy has a massive distribution network—nearly 7,000 retail stores nationwide. Tandy's stores offer supplies and repair services for the DMP 310, but you won't find a price discount.

The top of the DMP 310 is flat, so you can lay a portable PC on it. This design uses a straight paper path, with the paper exiting the printer's right side. A built-in paper tray holds 30 standard cut sheets. In addition, you can manually feed legal-size paper, multipart forms, or envelopes after removing the paper tray.

The printer measures 2.0 by 14.6 by 11.3 inches and weighs 5.8 pounds. The included 60-MHz 110V AC adapter adds 0.8 pounds. An optional $59.95 battery holder and the two nickel cadmium batteries ($19.95 apiece) add 1.7 pounds. When fully charged, the batteries provide about 1.8 hours of service, nearly 130 pages (a charger sells for $9.95). The batteries can be recharged 400 times.


Tandy DMP 310 Slimline Printer

The DMP 310's control panel has three push-button switches and five LED indicators, but it doesn't allow for full control of the printer parameters. These are taken care of by 11 convenient, labeled switches at the bottom of the unit.

The printer has 12K of memory built in, 11K for downloading fonts, and only 1K as a buffer. On our Text Speed test, it was the slowest 24-pin printer, scoring 30 characters per second in quality mode and 43 cps in draft mode. Its graphics speed of only 0.3 graphics pages per minute is acceptable for a portable.

Courier and a line printer font are the only two typefaces available. Text characters were well-formed; the bold Courier is particularly attractive. The printer, which handles 360 by 180 dots per inch, produced graphics output of solid dot matrix quality.

The DMP 310 lacks desktop-strength speed, but it offers portability and quality at a reasonable price.

Tandy Corp., *1800 One Tandy Center, Fort Worth, TX 76102; 817-390-3011.*

Tandy DMP 310 Slimline Printer *List price: $399.95; black multistrike ribbon, $14.95; battery pack, $59.95; additional nickel cadmium batteries, $19.95 each. Dimensions (HWD): 2.0 x 14.6 x 11.3 inches. Weight: 5.8 pounds; with AC adapter, 6.6 pounds.; with AC adapter, battery holder, and two batteries, 8.3 pounds. Emulations: Epson EX-1000, IBM Graphics Printer, IBM Proprinter, Tandy DMP 310. Circle 528 on reader service card*

Unisys Corp.

Unisys AP 1371

BY JOSEPH DESPOSITO

Superb construction and outstanding performance categorize the $3,295 Unisys AP 1371, from Unisys (manufactured by Bull Italia). But this quality 18-pin wide-carriage printer carries a steep price, and its options aren't cheap.

The AP 1371 comes with 32K of RAM, three emulations—Epson EX, Epson FX, and IBM Proprinter—and three fonts. Eight bar code sets are also standard, including Postnet. An optional $99 credit card–size font cartridge adds eight more fonts, which are automatically added as options on the printer's control panel. A $249 cartridge adds a Prism Plus emulation of the Dataproducts printer. To use the built-in color capability, you will need a $55.10 four-color ribbon.

Unisys positions this printer, which handles 240 by 144 dots per inch, as a high-end dot matrix or low-end line printer. On our Text Speed test, the AP 1371 outran all of the 9-, 18-, and 24-pin dot matrix printers, but its text speeds can't compare with the narrow-carriage speeds of the high-end line printers in this roundup. It posted 281 characters per second in draft mode and 129 cps in quality mode. Graphics speed was a commendable 1.9 graphics pages per minute (Epson emulation). Text and graphics output are

Unisys AP 1371

NEW BREED

486SX/33—$1999

This Hyundai 486SX-33 can out-muscle those barnyard bovines of cow country. But you be the judge.

Our 32 Megapixel "Longhorn" Local Bus?... or a 1 Megapixel moo cow? Our "faster-than-a-blink" *Windows accelerator video processing* tied to the speed of your 486 CPU?... or an old-fashioned bottleneck? Our *1MB VRAM controller* producing 1024 x 768 ultra-high, non-interlaced resolution?... or their tired cow VGA? Clearly, the prize goes to the Hyundai New Breed.

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Hyundai 433S

- 33MHz 486SX w/ 8KB integrated cache
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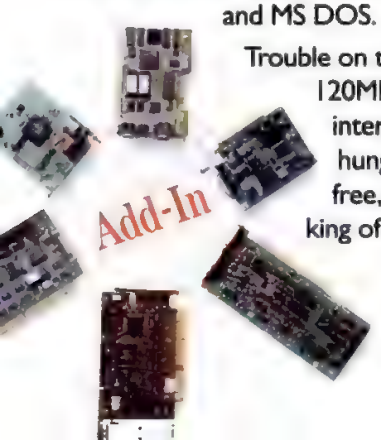
- 2S/1P, integrated PS/2 mouse port
- 5 external drive bays, 2 internal
- 7 expansion slots, including 1 VESA local bus slot
- 200 watt power supply
- 101 keyboard, 2 button mouse
- Built-in virus protection, front keylock, 2 level password
- MS DOS 5.0 and MS Windows 3.1

Hyundai 433S

Want to talk add-ins? We test our 486 systems with literally hundreds of industry-standard cards and software applications. We test software compatibility on Novell (we're fully certified and a Novell Alliance Program member), Banyan Vines, OS/2 2.0, LAN Manager, and SCO UNIX, plus hundreds of programs running under Windows and MS DOS.



Trouble on the data frontier? Relax. The Hyundai 433S is loaded. A beefy 120MB superfast hard disk, two floppy drives, five external/two internal drive bays, and seven expansion slots mean you won't go hungry for performance. And dressed up with our 14" flicker-free, non-interlaced, color display, the New Breed 433S is the new king of PC country.

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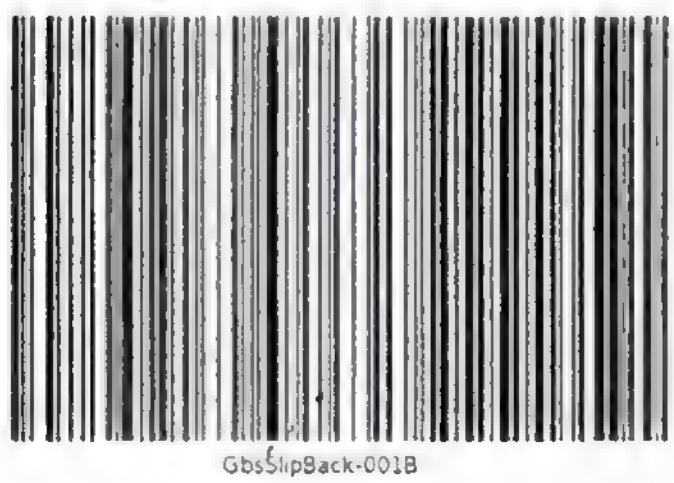

Back

1. Follow instructions on the other side

Inverted Back

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GbsSlipSheet-001

Foldout slip-sheet

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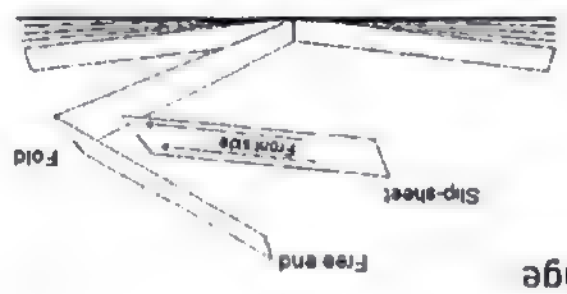
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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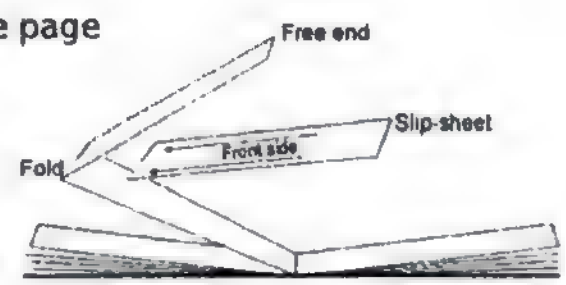
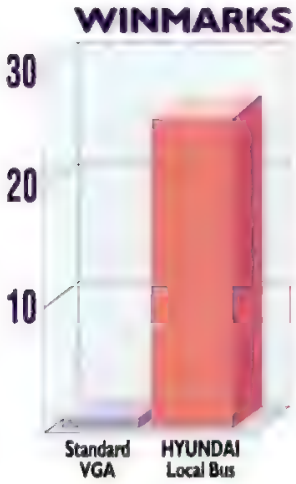


DO SOMETHING

486 STAMPEDE

That thunder you hear on the PC prairie is the New Breed Hyundai 486 stampede. The hardest-charging, price-lean, MIPS-mean herd of computers you'll ever see. We're bringing everything from powerful 66MHz 486DX2 machines to Overdrive-Upgradable 486SX-25 computers. And with our 50MHz 486DX2 desktop PC and 486DX-33 blasters, you can handle today's demanding applications.



Do something "Longhorn" Local Bus.

That flash you see on the graphics horizon is the image of our Windows processing power triggering the Hyundai 486 stampede.

Your 486 processor was meant to run today's applications. So why rein in all that power? That out-to-pasture, 16-bit VGA card can only deliver 2 Megapixels at best. That's already dated technology. Let her rip with 32-no-blink-bits of "Longhorn" *Local Bus video acceleration*. And with up to 32 Megapixels *standard*, believe it, you'll see an incredible difference in Windows performance.

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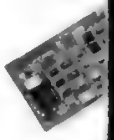
Do something upgradable.

The Hyundai 486 New Breed Family is designed in Silicon Valley, U.S.A., to out-perform the herd.

All of our systems are *CPU-upgradable* through a single chip via a *ZIF or Overdrive socket*, so the New Breed lets you double your speed. We won't let tomorrow's 32-bit operating systems blast a hole in your productivity. Just upgrade your Hyundai 486 to any higher-speed Intel 486 CPU in the future.



AND PUT THE OLD BREED OUT TO PASTURE.

Every cow has its day. But it's time to put that milker out to pasture and make way for the Hyundai 486 stampede. It's time to Do Something New Breed®.

Say goodbye to "cow-shed" engineering and mother-board-of-the-month manufacturing. At Hyundai, we're doing *U.S.-based, end-to-end, value engineering and manufacturing.* That means benchmark-blasting power from the new Hyundai family of 486 Systems.

And with up to *32 Winmarks* of Windows processing power, Hyundai's bulletproof, 32-bit 486 Systems are designed and engineered for your high-throughput applications. For instance, *Local Bus Graphics are standard* on every system, from our entry-level computers up through our top-of-the-line desktops. You'll tear through Windows with our razor-sharp, 32-bit processing. Plus, up to 32 Megapixels of mind-bending *GUI acceleration is standard* with every New Breed 486 from Hyundai. And here's more New Breed value engineering. Our expandable,"warpspeed" *L2 cache architecture is standard* on every Hyundai 486 system.

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DO SOMETHING

HEAD TO HEAD

i486SX-25 SYSTEM WITH NEW BREED POWER	HYUNDAI	GATEWAY
• 32-bit Local Bus Windows Accelerator	YES	NO
–15 Plus Winmarks of GUI Performance	YES	NO
–Motherboard Video w/1 MB VRAM	YES	NO
• 486 Level 2 Caching	YES	NO
–128KB Standard	YES	NO
–256KB Maximum Expansion	YES	NO
• 11 MIPS Max-Throughput	YES	NO
• Intel "Overdrive" Upgrade Socket	YES	NO

Hyundai 425SP
New Breed Power
Plus These Standard Features

• 4MB system memory expandable to 64MB on system board • 120MB 19ms IDE HDD, 32KB disk buffer • 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs • 14" non-interlaced, ultra-high resolution, .28 dot pitch, 72Hz refresh rate, flicker-free, color display w/1024 x 768 resolution, tilt-and-swivel base • 2S/1P, integrated PS/2 mouse port • 4 external drive bays • 5 expansion slots • 200 watt power supply • 101 keyboard, 2 button mouse • Built-in virus protection, front keylock, 2 level password • MS DOS 5.0 and MS Windows 3.1 • Optional cost: Full-Profile Chassis with 32-bit VESA local bus graphics. Call us. System shown with optional hardware.

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DO SOMETHING 66MHZ

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- 1.44MB 3-1/2" and 1.2MB 5-1/4" FDDs
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- 2S/1P, Integrated PS/2 mouse port
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DO SOMETHING EXTRA

We'll give you more than you bargained for. When you go with the 486 stampede, from our 425SP to our powerhouse 466D2TE, we give you exclusive *low prices on software*. Our size and reputation allow us to forge alliances with all the major players in the industry, which means we can bring you software specials from firms like Microsoft, Borland, Lotus, and Symantec.

Great deals on optional software!

Do something safe.

The PC range war can shake everybody's confidence. Except ours. We're a $50 billion global company, which means we have the resources to guarantee outstanding service and support. When you buy New Breed technology, you get New Breed service from a world-wide leader.

In addition to our service and support, we have a TQC (Total Quality Care) program that makes us the double-safe buy. Our 18-month warranty on all systems is a soft ride in the saddle.

The bottom line is your satisfaction. Buy the Hyundai 486 stampede, and you get more than New Breed technology. You get New Breed Service that leaves that old breed behind.

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- **One-year, next-business-day, on-site service with all direct orders, followed by 6-month, ship-in warranty on parts and labor.**
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- 66MHz 486DX2 CPU w/8KB integrated cache
- 128KB high-speed L2 cache
- 32-bit EISA architecture
- 8MB RAM standard (expandable to 32MB on system board and 96MB via memory expansion board)
- 32-bit caching SCSI host adapter
- 360MB 12ms SCSI HDD, 256KB disk buffer
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- SVGA graphics card
- 14" interlaced, ultra-high resolution, flicker-free, color display with 1024 x 768 resolution, .28 dot pitch, 72MHz refresh rate
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- 5 external and 2 internal drive bays
- 390 watt power supply
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Number of PCs in your current site_____ Brands you have standardized on_____
Other brands you are considering_____

Number of PCs installed 486_____ 386_____ 386SX_____ 286_____

Tell us about your targeted system configuration

CPU Type	❑ 486	❑ 486SX	❑ 386DX	❑ 386SX	❑ Notebook	
Architecture	❑ ISA	❑ EISA				
Memory	____MB installed	Cache Memory	❑ 128 KB	❑ 256KB		
Floppies	❑ 1.44MB 3-1/2"	❑ 1.2MB 5-1/4"				
Hard Disks (IDE)	❑ 100MB	❑ 120MB	❑ 200MB	❑ 250MB	❑ 330MB	❑ 500MB
(SCSI) **3.5"**	❑ 360MB	❑ 540MB	❑ 1.2GB			
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fine for an 18-pin printhead.

Printer operations are controlled through an 80-character LCD with membrane buttons. These include a tear-off feature, gap adjustment, and the ability to store four configuration settings.

Continuous paper feeds through the rear. To feed paper through the bottom, you must attach the $295 bottom push-tractor option, which is relatively easy to install. A single-sheet cut-sheet feeder is built into the front of the printer. An optional $660 130-page cut-sheet feeder sits beneath the printer and raises it by a couple of inches. You place the output paper stacker at the top of the printer. A second 130-sheet cut-sheet feeder, which costs $400, sits under the first.

Unysis sells its printers through its direct sales force and VARs, so don't expect to find a price discount.

Unisys sells its printers through its direct sales force and VARs, so don't expect a price discount. But if you can afford it, the AP 1371 will keep you satisfied with its performance as a dot matrix power house. And even though the AP 1371 can't keep up with the line printers, it offers paper-handling options that line printers don't. □

Unisys Corp., *Plymouth Plant, 41100 Plymouth Rd., Plymouth, MI 48170-1892; 800-448-1424; fax, 716-272-6671.*

EDITORS' CHOICE ▶ Unisys AP 1371 *List price: $3,295; font cartridge, $99; Prism Plus emulation card, $249; 130-sheet single-bin cut-sheet feeder with output stacker, $660; 130-sheet second-bin cut-sheet feeder, $400; push tractor, $295; black ribbon, $47.75; color ribbon, $55.10; desktop stand, $116; floor stand, $475; parallel cable, $70; serial cable, $30. Dimensions (HWD): 7.1 x 24.9 x 16.1 inches. Weight: 56.1 pounds. Emulations: Epson EX-1000, Epson FX, IBM Proprinter.*

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CIRCLE 167 ON READER SERVICE CARD

Which Printers Do You Rate the Highest?

Hewlett-Packard must be doing something right. But we don't have to tell you that; you told us. The results are in from *PC Magazine*'s 1992 Printer Service and Reliability Survey, and the users we polled ranked HP at the top of the industry in most of the categories, including overall printer reliability and the future likelihood that these users will buy another printer from the same vendor.

Epson America and Panasonic Communications & Systems Co. joined Hewlett-Packard Co. in receiving top honors for customer service and product reliability in our survey of *PC Magazine* subscribers—a study that confirmed a lot of conventional wisdom about the PC printer market while simultaneously uncovering a few surprises.

Survey respondents mostly used printers from Epson, HP, and Panasonic; collectively, these companies had their names on 62 percent of the printers that respondents said they had used in the past two years. Survey respondents also ranked HP, Panasonic, and Epson first, second, and third, respectively, in terms of their future likelihood of buying from the same vendor. Customer satisfaction with printers from these three companies—which are all key players in the industry—suggests that market dominance correlates to high customer loyalty.

"It's always nice to know there are a lot of other people with the same product," explained survey participant Monte Davis. "For example, I use the on-line vendor forums on CompuServe a lot. If you can't get through on a company's tech support line, you can leave a message [in the vendor forum], and you can be pretty sure there's another user out there who can help."

One of the surprises revealed by the survey was how many users of Star Micronics America's printers reported that their printers never required a service call. Although Star Micronics received average marks when its customers actually needed service and support, a full 67 percent of Star Micronics users said their printers never required repair service, and 61 percent said they never required any form of technical support from the company itself. Star Micronics is primarily a player in the dot matrix printer market.

Representative of the company's users is survey respondent John Watkins, who said he

We asked 15,000 *PC Magazine* readers how their printers—and the vendors that make them—measure up under real-world conditions. Here's what the 7,526 responses said. A few answers surprised even us.

by Don Steinberg

How Readers Rate Their Printer Vendors

An analysis of how *PC Magazine* survey respondents rated printer companies on the four key service and reliability measures (overall reliability, future likelihood of buying from the same vendor, satisfaction with repair experience, and satisfaction with technical support) showed that Epson, Hewlett-Packard, and Panasonic are tops in our readers' eyes.

These three companies scored significantly higher than the average in all four categories. Companies shown here as being above average scored significantly higher than the average on some measures and average on others, but never below the average. Companies rated as average received all average ratings or a combination of positives and negatives that balanced to average for all four measures. Those rated as below the average scored significantly lower than the average on some measures but not significantly higher on any. The company rated as poor scored significantly lower than the average in all four categories.

	Overall reliability	Future likelihood of buying from the same vendor	Satisfaction with repair service	Satisfaction with technical support
Excellent				
Epson America	8.8	7.7	7.8	7.6
Hewlett-Packard Co	9.3	9.2	8.5	8.4
Panasonic Communications & Systems Co.	8.9	8.0	7.8	7.4
Above average				
Apple Computer	8.5	6.8*	7.4*	7.3*
Canon USA	8.6*	7.4	7.5*	7.3*
Citizen America Corp	8.5	7.3	7.5*	7.5
Digital Equipment Corp	8.1*	6.2*	7.4*	7.7
IBM/Lexmark International	8.4*	6.6*	7.3*	7.5
Okidata	8.5	7.3	7.6	7.4*
Average				
Brother International Corp. USA	8.3*	6.3*	7.1*	6.8*
Fujitsu Computer Products of America	8.3*	6.3*	6.9*	7.2*
Kyocera Electronics	8.4*	6.4*	7.7*	7.3*
NEC Technologies	8.5*	7.1	6.9*	6.7
QMS	8.3*	7.5	6.9*	6.6
Star Micronics America	8.4*	6.6*	7.4*	7.5*
Texas Instruments	8.2*	6.8*	6.6*	6.6*
Below average				
ALPS America	8.3*	5.6	6.5	6.7*
Eastman Kodak Co.	7.8	6.1*	7.1*	7.4*
Tandy Corp.	8.1*	4.7	6.6*	6.4
Toshiba America Information Systems	8.0	5.6	6.7*	6.6*
Poor				
Dataproducts Corp.	6.9	5.1	5.5	5.9
Average ratings	**8.3**	**6.7**	**7.2**	**7.1**

* This rating does not differ significantly from the average.

has been using a low-end dot matrix machine from Star Micronics for seven years without a problem. "It's a super-cheapie 9-pin," Watkins said, "but it just keeps on going."

Star Micronics' ratings also reveal something about the industry as a whole, showing that even companies with the most hassle-free printers leave at least one-third of their products needing some form of repair at some point in time. So even though printer manufacturers have been improving their product lines for a decade—putting more dots per inch on more pages per minute for less money—they have not fully mastered the art of reliable printing.

Filling a blank sheet of paper with intelligible information has been one of humankind's greatest challenges; there is no reason to think that a faster roller mechanism or a better technology for putting ink on a page will change things too dramatically.

Given the ageless truth that things can still break down, even with giant leaps in performance standards, it follows that users polled in the survey are most loyal to the companies that excel in service, support, and product reliability. Excellence in speed, output quality, and other individual aspects of performance (which this survey also measured) didn't always correlate highly with users' willingness to buy from the same company again. Rather, this decision seems to be most directly related to customer satisfaction with repair experiences, technical support, and overall product reliability.

THE SURVEY

We mailed our survey questionnaire to a random sample of 15,000 *PC Magazine* subscribers in June 1992. (See "How We Conducted the Survey" for more details.) We divided the 11 questions into two categories. The first category dealt with customers' satisfaction when it came to product reliability, their future likelihood of buying another printer from the same vendor, and their satisfaction with repair experiences and with technical support.

The second category of the survey evaluated customer satisfaction with individual concerns or performance measures. These included the output quality; the speed when printing text, printing graphics, and printing from Microsoft Windows applications; the ease of installing supplies (ribbons and toner, for example); printing documents with multiple fonts; the ability to print envelopes; and the ability to switch between PostScript and HP PCL (HP's Printer Control Language).

In an effort to understand each manufacturer's relative performance in this area, we combined responses from the first category of questions to separate printer vendors into five groups, which represent distinct tiers. Only the companies that scored significantly higher than average on all four service and reliability questions made the grade-A tier. (See the chart "How Readers Rate Their Printer Vendors" for more information.)

To get more in-depth answers to our survey questions, we conducted phone interviews with a random sample of survey respondents.

INDUSTRY GENERALIZATIONS

Our survey data reveals a few intriguing trends about users' general happiness with today's PC printers. For example, users indicated that within the realms of our survey, their printers performed best in terms of output quality and ease of installing supplies. The participants felt the area that could use the most improvement is the printers' ability to print envelopes—particularly for dot matrix printers. Although a few vendors devote particular attention to the problem of placing addresses on envelopes, industry-wide performance here generally trailed that of other categories, according to our respondents. Long live the typewriter!

Another area where participants thought their printers could stand improvement—once again dot matrix printers in particular—was speed when printing graphics and when running under Windows.

Interestingly, the combined average number that users gave their printers for overall reliability was substantially higher than the average on each performance issue, and higher than the printers' combined average ratings for the question on the future likelihood of buying from the same vendor. This may indicate that even satisfied users are often willing to shop around. Either that, or you simply can't always buy what you want, especially during a time of organizational budget cutting. (For more information, see the chart "How Readers Rate Their Printer Vendors.")

LASER VS. DOT MATRIX VS. INK JET

As you might expect, laser printers outscored dot matrix and ink jet printers in all industry-wide performance categories. Among individual companies that offer both lasers and other printer types, the lasers generally received higher marks, even on issues of vendor support. (Remember, though, that poll respondents merely rated the printers they have used and did not compare one printer type to another.)

The few exceptions to laser technology's dominance are therefore noteworthy. (See the chart "How Readers Rate Their Printer Vendors" for more information.) Ink jets topped lasers in their ease of installing supplies. Notably, the HP DeskJet printers (ink jet machines) outscored or equaled most of HP's LaserJet printers in this category. Survey participant Tom Klingelhoefer said his color HP DeskJet 500C, which he has at home, is a lot more convenient to use and maintain than the networked HP LaserJets he uses at work. He explained that swapping between the machine's color and black-ink cartridges is a snap on the DeskJet 500C, compared with changing the toner cartridge on the laser printer.

Ink jet printers ceded output quality and speed to Canon Computer Systems. Survey participant Davis, who uses both a Canon laser printer and a Canon ink jet printer, pointed out that Canon's lasers are "just one in a crowd" of competitive products from a host of other companies. In contrast, the Canon BJ-10e, a portable ink jet printer, was a landmark machine when it debuted. And that unit still has little competition.

"I've taken it everywhere, and it has been a real workhorse for me," Davis said. Davis added that Canon lasers—under Canon's competitive agreement with OEM customer HP—are not compatible with industry-standard HP drivers. That's why he might look to other manufacturers the next time he buys a laser printer.

NETWORK VS. STANDALONE PRINTERS

The survey also asked whether each of the 18,130 rated printers was networked; 26 percent were. Whether a printer was a networked machine or a standalone unit seemed to correlate to user satisfaction in many areas. Satisfaction levels among users of networked printers significantly exceeded those of users of non-networked printers in such areas as speed

How We Conducted the Survey

by Jaime LeVine

In June 1992, we mailed questionnaires to a random sample of 15,000 *PC Magazine* subscribers. The survey was closed for tabulation purposes on August 3, 1992, at which time we received 50 percent back. The data cited in this report is based on the responses in the 7,526 usable questionnaires that were returned.

In each questionnaire, we asked readers to describe each of the printers they have used over the past two years, telling us the manufacturer, printer type, printer speed, and whether the printers were networked. Next, respondents rated the overall reliability of each of these printers and their satisfaction with the repair service and technical support they had received.

In addition, we asked them to rate their level of satisfaction with such concerns as each printer's output quality and how well each could print documents with multiple fonts. Respondents used a rating scale of 1 to 10, with 1 representing "not at all satisfied" and 10 representing "very satisfied."

To analyze the results, we calculated an individual average score for each manufacturer or printer type in categories where readers rated the printers. We obtained an overall average by adding all of those individual averages and dividing by the number of manufacturers or printer types. In this way we were able to calculate a score that was not weighted by market share; each manufacturer or printer type contributed equally.

The differences cited in the report are all statistically significant at the 95 percent confidence level, which simply means that if we conducted exactly the same study 100 times, chances are the differences presented in this report would occur at least 95 times. However, we do point out those differences not statistically significant at that level in the charts accompanying this story.

Significance-testing factors the sample sizes as well as the magnitude of the difference into the scores. Variations in sample size can sometimes produce an anomalous result where companies that overall appear relatively close to each other in rank may in fact have statistically significant differences in their scores, while companies that appear relatively far apart in overall ranking may not. □

of printing and output quality.

This makes sense. Printers that a corporate buyer selects for network duty are more expensive, faster, and of a higher quality, said survey respondent Walter Roberts. Roberts maintains PC systems for a publishing company that pumps tens of thousands of documents monthly through networked NEC Technologies lasers.

Another element contributing to the ratings might be the fact that most users' problems with networked printers are handled by someone else—a systems manager or network administrator. Added Roberts, "When a network printer goes down, so many people are impacted that repairing it becomes an immediate priority. But when somebody's little IBM Proprinter goes down, you send out [for repairs]."

VENDOR SERVICE AND RELIABILITY

On the question of overall reliability, HP ranked number one, followed by Epson and Panasonic (these two companies tied). User likelihood of buying another printer from the same company tallied up similarly, with HP, Panasonic, and Epson placing first, second, and third, respectively.

User satisfaction with printer repair experiences (either performed by themselves or by others) and with technical support put only a slight twist on these ratings. HP ranked first in satisfaction, followed by Epson and Panasonic (they tied here as well). But in satisfaction with technical support, Digital Equipment Corp. managed to tie Epson for second place. HP ranked first.

We hate to finger a single company for subpar ratings, but Dataproducts Corp. was the only vendor to receive a failing grade. It alone tallied scores significantly below industry averages on all four of our service and reliability questions.

VENDOR PRODUCT PERFORMANCE

In individual performance categories, Apple Computer, HP, Kyocera Unison, and QMS topped the field in most measures. All of these companies sell mostly lasers printers, the exceptions being HP (with its DeskJets) and QMS (with its dye-diffusion thermal-transfer color printers).

Canon and HP both rated well in terms of the ease of installing supplies, but HP again placed first.

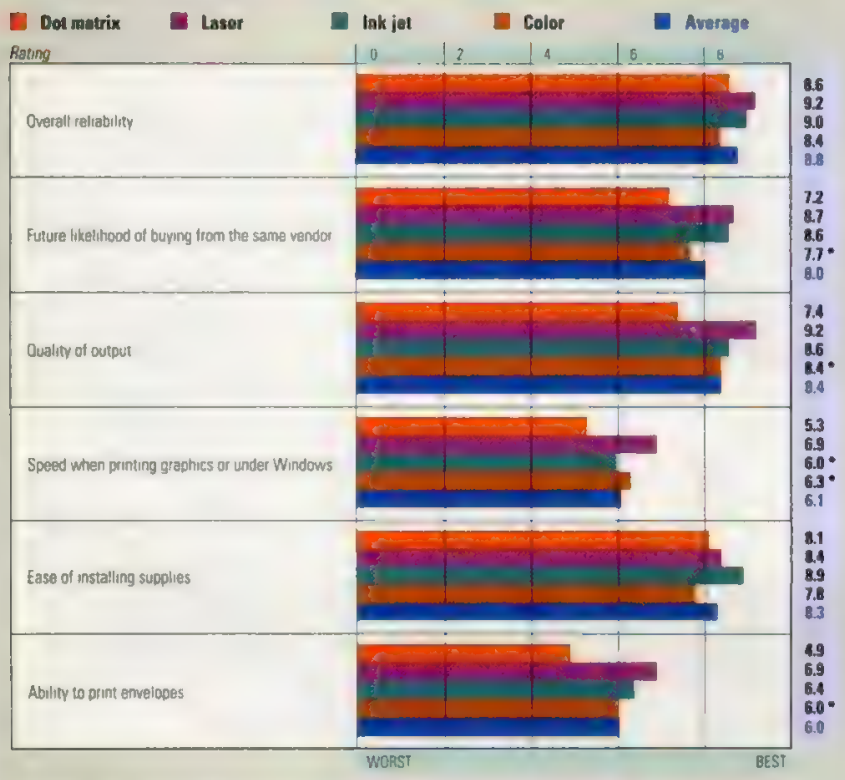
Canon and HP both rated well in terms of the ease of installing supplies, although HP again placed first. This may be no surprise. Canon fathered the print engine that combines toner and drum into a single, convenient, lift-out unit. And the widest implementer of Canon's engine is HP, whose laser printers have been built around the engine since the original HP LaserJet in 1984. Panasonic also rated well. Its laser printers use Matsushita engines instead of Canon engines.

Printers from Brother International Corp. USA, HP, and Lexmark International were relatively well rated for their envelope handling. Survey respondent Klingelhoefer said HP's optional multipaper-type feeder for envelopes works satisfactorily. But, he joked, "it's almost as expensive as the HP LaserJet." Lexmark, the company IBM spun off to market printers, also offers an envelope cassette feeder for its lasers. Brother's dot matrix machines have a dual-direction feeding mechanism that you can use to pull or push incoming paper.

Bringing up the rear in the mentioned performance categories were companies that sell primarily dot matrix and ink jet printers: Dataproducts, Eastman Kodak Co., Tandy Corp., and Toshiba America

What Keeps Customers Coming Back?

Although performance is important to users, survey respondents more heavily weighted printer reliability and their satisfaction with repair experience and technical support as reasons for repeat purchases. Note that performance issues, such as a printer's ability to handle envelopes or its speed when printing graphics or from Microsoft Windows applications, do not always correlate to users' likelihood of buying from the same company in the future. Reliability seems to weigh much more heavily in the decision. (The ratings marked with an asterisk are those that do not have a statistically significant difference from the average in our survey.)



* This rating does not differ significantly from the average

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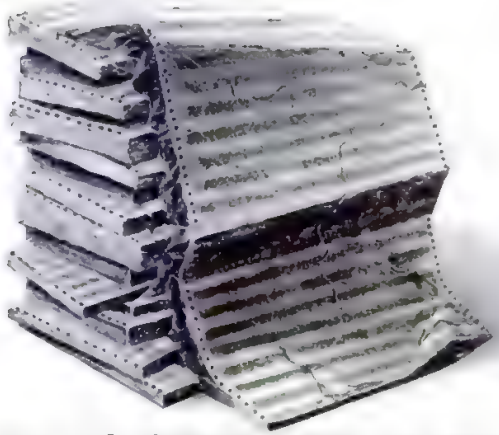

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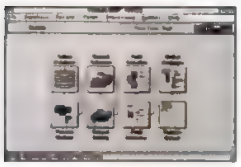

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CIRCLE 247 ON READER SERVICE CARD

Information Systems. Of course, it really isn't fair (or helpful) to compare these companies' printer performance ratings against those of companies that primarily sell lasers.

BUT WHO FIXES IT?

In addition to rating the printers they've used, participants told us where they obtain repair service and technical support. The responses we received were revealing. Most compelling, as we pointed out earlier, was the number of users who indicated they have never needed repair service or tech support for their printers. (See the chart "The Repair Service Report Card" for more information.) The bad news: Out of the 18,130 printers included in this survey, 8,677 were reported to have required repair calls at some point. That's pretty high—about 48 percent. But the good news is that almost as many, a respectable 44 percent, never required a call to the technical support department.

Out of the 18,130 printers included in this survey, 8,677 were reported to have required repair calls at some point.

Industry-wide, printer technical support comes primarily from manufacturers and in-house systems departments, according to the survey responses. Printer repair, on the other hand, comes mainly from third-party service organizations and in-house systems departments, though hardly ever directly from the manufacturer.

Star Micronics was rated as the most trouble-free printer company, while Panasonic placed second in terms of never needing either repair service or technical support. Citizen America Corp. ranked third when it came to repair-free machines, and Eastman Kodak placed third in requiring the least support.

HP finished in the middle of the pack among manufacturers whose printers never required a repair call. But an analysis of individual HP models proved informative: The HP DeskJet was rated more trouble-free than any of the company's LaserJets. HP customer Klingelhoefer, whose survey response contributed to this finding, backed it up with anecdotal evidence. He admitted having "nagging, intermittent" paper-feed difficulties with his LaserJet IIISi but said his DeskJet 500C has been trouble-free.

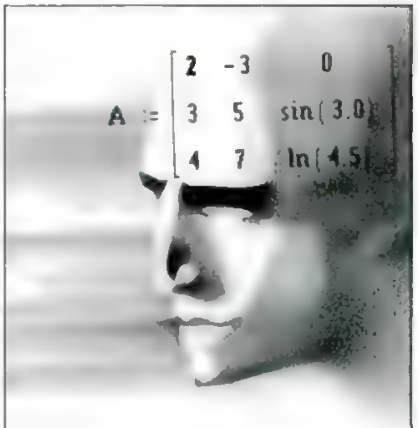
Companies bottoming out the list of printers that never required repair service—those whose machines overall require the most outside help to stay running—were Dataproducts (84 percent of its surveyed printers needed both repairs and technical support), Digital (78 percent needed repairs, and 82 percent needed support), and Kyocera (77 percent needed repairs, and 73 percent needed support).

We think this all sends a message to printer vendors: Service and reliability are destined to remain key issues for those of us who buy PC printers. Printers will continue to support an increasing number of fonts, more users, higher resolutions, and greater paper volumes for less money. But if they aren't kept ready to print at the moment a user needs them, they aren't worth a cent. □

The Repair Service Report Card

We asked survey respondents to tell us about their printer repair histories. In the table below, higher numbers represent larger numbers of users with trouble-free units. At least half of the users of these manufacturers' printers reported that their printers never needed repair service.

Manufacturer	Percentage of respondents who reported no repair calls
Brother International Corp. USA	57
Canon USA	58
Citizen America Corp.	62
Eastman Kodak Co.	60
Hewlett-Packard Co.	50
Epson America	58
Panasonic Communications & Systems Co.	66
Star Micronics America	67
Tandy Corp.	55



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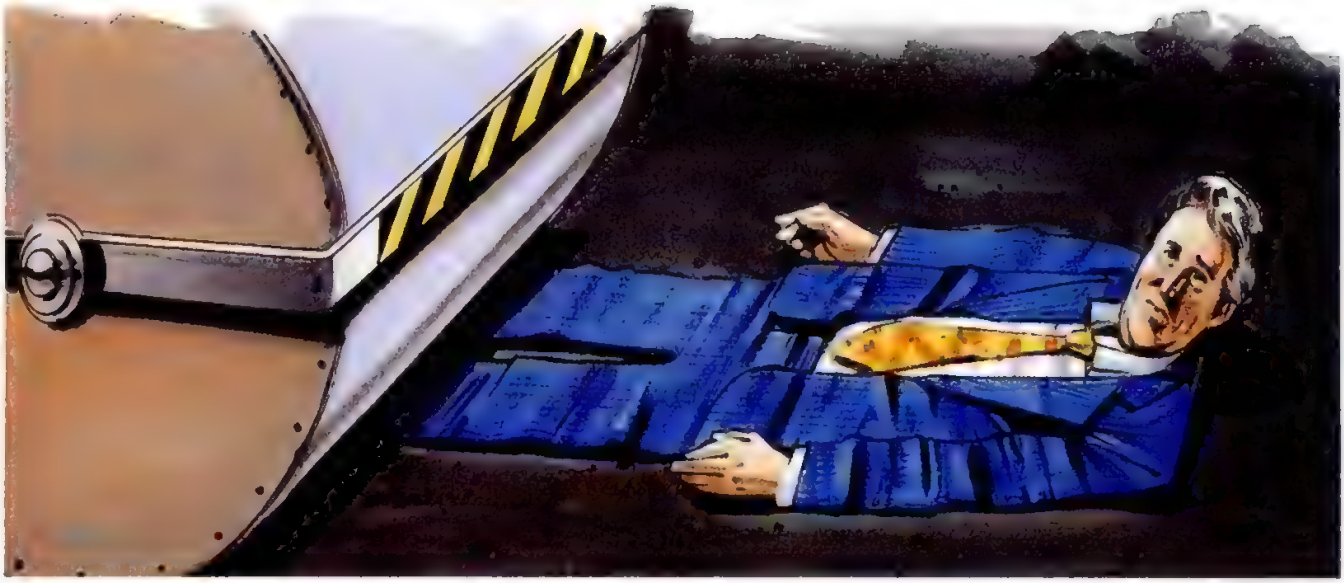

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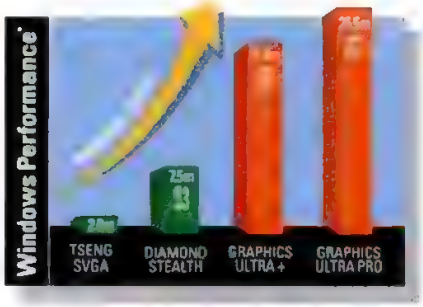

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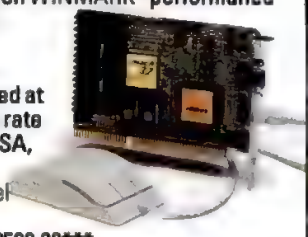

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Index to Printer Reviews (1984–1992)

Over the last nine years, PC Magazine Labs has tested more than 900 printers for reviews in nine annual issues, plus our review of portable printers (August 1992). Of the units reviewed in previous issues, over 200 are still available from the manufacturers; they are included in this index, along with 100 new printers reviewed in the current issue.

We have listed engine types, current prices (as of September 1, 1992), and, for most products, speed scores on PC Labs' Text Speed test. For the color PostScript printers reviewed this year, however, we list the Graphics Speed score. For your reference, we have also provided the volume, issue, and page numbers of the original reviews. Products whose names are followed by * have been replaced by upgraded models, but these upgrades were not considered significant enough to warrant a new review in *PC Magazine*, or, in certain cases, the company chose not to submit an upgraded machine for review. The prices listed for these machines are those of the upgraded models; please refer to the vendor for more specific product information. For printers that have stayed the same while their names have changed, we use the new names.

Since most dot matrix printers are now available with color options, we no longer differentiate between monochrome and color-capable dot matrix printers. The price listed in each case is for the standard printer, without a color option. Because color PostScript printers belong in a catagory of their own, we have indicated which thermal wax transfer, dye sublimation, and solid-ink PostScript-compatible printers handle color.

***PC Magazine*'s new Text Speed test remains almost identical to the old version; the Graphics Speed test has changed more significantly. You should keep this in mind when comparing speeds across nine years of products. Page printer speeds are measured in pages per minute (ppm); dot matrix and ink jet speeds are measured in characters per second (cps), line printers in lines per minute (lpm), and this year's color PostScript printers in graphics pages per minute (gppm). For most dot matrix and ink jet printers, we indicate draft text speed, unless the product offered a quality mode only. While laser print speed is not directly comparable with dot matrix or ink jet speed, a score of 1 ppm falls roughly within a range of 25 to 30 characters per second for double-spaced text, or 50 to 60 cps single-spaced.**

For quick comparison of output and test results of the printers reviewed in this issue, see the *PC Magazine* Printer Guides.

Company name	Product	Type	Speed	Price	Vol.	No.	Pg.	Reader Service Number
A								
Advanced Matrix Technology	Accel-212	DM	122 cps	$469	11	20	327	511
Advanced Matrix Technology	Accel-214	DM	122 cps	$529	11	20	327	511
Advanced Matrix Technology	Accel-242	DM	118 cps	$529	11	20	327	511
Advanced Matrix Technology	Accel-244	DM	117 cps	$595	11	20	327	511
Advanced Matrix Technology	Accel-292	DM	151 cps	$795	11	20	327	511
Advanced Matrix Technology	Accel-294	DM	119 cps	$895	11	20	327	511
Advanced Matrix Technology	Accel-500*	DM	161 cps	$1,485	8	19	345	
Advanced Matrix Technology	TracJet Laser Printer	L	14.7 ppm	$4,995	11	20	224	503
AEG Olympia	■ NP 136-24	DM	118 cps	$395	8	19	246	
AEG Olympia	NP 136SE	DM	145 cps	$314	9	19	334	
AEG Olympia	NP 80-24	DM	115 cps	$369	8	19	246	
AEG Olympia	NP 80-24E	DM	105 cps	$327	9	19	334	
AEG Olympia	NP 80SE	DM	126 cps	$330	9	19	334	
AEG Olympia	NPC 136-24	DM	96 cps	$495	8	19	345	
ALPS	Allegro 500	DM	113 cps	$499	9	19	345	
ALPS	Allegro 500XT	DM	138 cps	$799	9	19	345	
ALPS	APS1600	DM	59 cps	$299	9	19	339	
ALPS	DMX800	DM	265 cps	$2,195	11	20	352	512
ALPS	ALPS LSX1600	L	13.6 ppm	$3,295	11	20	230	505
Apple	LaserWriter IIf	L	7.1 ppm	$3,299	11	20	158	492
Apple	LaserWriter IIg	L	7.1 ppm	$4,299	11	20	158	492
Apple	Personal LaserWriter NTR	L	3.9 ppm	$2,199	11	20	158	492
AT&T	570*	DM	124 cps	$755	8	19	250	
Axonix	MilWrite	DM	95 cps	$1,395	11	20	361	514
B								
Bézier	BP4040	L	3.9 ppm	$1,195	10	20	150	
Brother	HJ-100i	IJ	42 cps	$499	11	14	331	
Brother	HL-4PS	L	3.8 ppm	$2,595	10	20	156	
Brother	HL-4Ve	L	4 ppm	$1,595	11	20	159	493
Brother	HL-8V	L	7.6 ppm	$2,495	10	20	156	
Brother	■ HL-8PS	L	7.4 ppm	$4,495	8	19	120	
Brother	HL-10V	L	9 ppm	$1,995	11	20	159	493
Brother	HT-500PS	CTT	0.2 gppm	$4,995	11	20	259	470
Brother	M-1309	DM	105 cps	$299	10	20	414	
Brother	M-1324	DM	106 cps	$399	10	20	414	
Brother	M-1809	DM	83 cps	$549	8	19	350	
Brother	M-1824L	DM	121 cps	$749	8	19	352	
Brother	M-1909	DM	129 cps	$699	9	19	345	
Brother	M-1924L	DM	122 cps	$949	9	19	346	

■=Editors' Choice, C=color, DM=dot matrix, DS=dye sublimation, DW=daisy wheel, IJ=ink jet, L=laser, SI=solid ink, TT=thermal transfer
* This machine has been replaced by an upgraded model.

CONTINUES

Index to Printer Reviews (1984–1992)

Company name	Product	Type	Speed	Price	Vol.	No.	Pg.	RSN.
Brother	M-4309A	DM	258 cps	$2,195	11	20	352	513
Bull	Compuprint 4/22	DM	117 cps	$375	9	19	348	
Bull	Compuprint 4/23	DM	116 cps	$525	9	19	348	
Bull	Compuprint 4/24	DM	113 cps	$640	9	19	351	
Bull	Compuprint 4/40	DM	154 cps	$935	9	19	351	
Bull	Compuprint 4/43	DM	142 cps	$1,995	9	19	352	
Bull	Compuprint 4/68	DM	192 cps	$1,895	9	19	358	
Bull	Compuprint 970	DM	284 cps	$2,595	10	20	415	
C								
Calcomp	ColorMaster Plus 6603PS	CTT	0.9 ppm	$4,995	10	20	329	
Calcomp	ColorMaster Plus 6613PS	CTT	0.3g ppm	$6,995	11	20	262	471
Canon	BJ-10ex Bubble Jet Printer	IJ	42 cps	$499	11	14	331	
Canon	BJ-20 Bubble Jet Printer	IJ	45 cps	$599	11	20	292	530
Canon	■ BJ-300 Bubble Jet Printer	IJ	198 cps	$699	10	20	366	
Canon	■ BJ-330 Bubble Jet Printer	IJ	198 cps	$849	10	20	366	
Canon	BJC-800 Bubble Jet Printer	IJ	74 cps	$2,795	11	20	292	530
Canon	LBP-4*	L	3.9 ppm	$1,545	9	19	156	
Canon	LBP-8 Mark III*	L	7.3 ppm	$2,495	8	19	124	
Canon	LBP-8 Mark IIIR	L	7.4 ppm	$3,795	9	19	165	
Canon	LBP-8 Mark IIIT	L	7.5 ppm	$3,295	9	19	165	
CIE	CI-250 LXP	DM	242 cps	$2,295	10	20	420	
CIE	CI-500	DM	257 cps	$5,795	10	20	420	
CIE	CI-1000	DM	388 cps	$7,695	9	19	364	
CIE	CI-5000	DM	250 cps	$1,995	9	19	358	
Citizen	GSX-130	DM	127 cps	$399	10	20	421	
Citizen	GSX-140 Plus	DM	112 cps	$499	10	20	421	
Citizen	GSX-145	DM	100 cps	$599	10	20	421	
Citizen	GSX-240	DM	130 cps	$499	11	20	362	516
Citizen	PN48 Notebook Printer	DM	24 cps	$469	11	14	338	
Citizen	■ 200GX	DM	108 cps	$299	9	19	360	
Citizen	200GX Fifteen	DM	100 cps	$499	10	20	421	
Compaq	■ PageMarq 15	L	12.8 ppm	$3,999	11	20	233	506
Compaq	■ PageMarq 20	L	16.5 ppm	$5,499	11	20	233	506
C-Tech	ProWriter C-240	DM	113 cps	$449	9	19	365	
C-Tech	ProWriter C-245	DM	110 cps	$559	9	19	365	
C-Tech	ProWriter C-310 XP	DM	157 cps	$739	5	19	174	
C-Tech	ProWriter C-315 XP	DM	150 cps	$919	5	19	174	
C-Tech	ProWriter C-610II	DM	120 cps	$799	11	20	361	515
C-Tech	■ ProWriter C-615II	DM	124 cps	$1,175	11	20	361	515
C-Tech	ProWriter C-645	DM	168 cps	$1,395	9	19	371	
C-Tech	ProWriter CI-4	L	4 ppm	$1,245	10	20	164	
C-Tech	ProWriter CI-8	L	7.4 ppm	$2,395	11	20	162	494
C-Tech	ProWriter CI-8E	L	7.5 ppm	$1,695	11	20	162	494
D								
Dataproducts	9030	DM	136 cps	$669	9	19	372	
Dataproducts	9044*	DM	104 cps	$1,132	9	19	372	
Dataproducts	LX 455	DM	443 lpm	$4,595	11	20	366	517
Dataproducts	LZR 960	L	8.1 ppm	$2,195	10	20	164	
Dataproducts	LZR 1555	L	12.5 ppm	$5,995	11	20	236	507
Dataproducts	LZR 1560	L	12.3 ppm	$5,695	11	20	236	507
Datasouth	DS 180	DM	128 cps	**	3	23	223	
Datasouth	Performax	DM	308 cps	$2,995	10	20	432	
Datasouth	XL-300	DM	184 cps	$1,595	10	20	432	
DCS/Fortis	■ DM2215	DM	132 cps	$495	8	19	268	
DCS/Fortis	DM3215	DM	125 cps	$699	9	19	391	
DCS/Fortis	DQ4210	DM	122 cps	$589	8	19	273	
DCS/Fortis	DQ4215	DM	100 cps	$899	8	19	364	
Digital Equipment Corp.	DECmultijet 1000	IJ	69 cps	$329	11	14	342	
Digital Equipment Corp.	DEClaser 1150	L	3.9 ppm	$1,799	10	20	166	
Digital Equipment Corp.	DEClaser 2100	L	7.5 ppm	$1,599	9	19	232	
Digital Equipment Corp.	DEClaser 2150	L	7.4 ppm	$2,299	10	20	166	
Digital Equipment Corp.	DEClaser 2200	L	7.6 ppm	$2,599	9	19	232	

■=Editors' Choice, C=color, DM=dot matrix, DS=dye sublimation, DW=daisy wheel, IJ=ink jet, L=laser, SI=solid ink, TT=thermal transfer
* This machine has been replaced by an upgraded model. ** This printer is available by special order only. Prices vary

CONTINUES

Acer

Introducing new innovation color monitors—AcerView 56i 76i

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intelligence on screen

The innovative intelligent iScreen is designed especially for your needs. An additional window for more interaction between you and your monitor.

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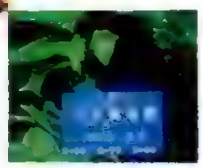
Multi-language menu


iColor

With simple key operations, iScreen provides excellent and precise image quality. The key to iScreen technology lies in the interactive features on the screen adjustment menus. These menus allow you to adjust display parameters such as brightness, contrast image height, image width and even colors.

The AcerView internal iColor feature matches the monitor display colors exactly with the colors you want, you can adjust the red, green and blue color levels separately.

iScreen is a milestone in the history of the development of monitors. By choosing it, you are empowering yourself with the superiority of the iScreen.

- Super fine 0.28mm dot-pitch display
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- Flicker-free 76Hz refresh rate for resolutions up to 1024x768 depending on model
- Video bandwidths of up to 110MHz ensure future display mode compatibility

AcerView 14",15" and 17" monitors are yours for the taking.

ISO-9002

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CIRCLE 091 ON READER SERVICE CARD

Index to Printer Reviews (1984–1992)

Company name	Product	Type	Speed	Price	Vol.	No.	Pg.	RSN.
Digital Equipment Corp.	DEClaser 2250	L	7.4 ppm	$3,699	10	20	166	
Digital Equipment Corp.	DEClaser 3250	L	14.1 ppm	$4,799	11	20	236	508
Digital Equipment Corp.	LA 70 Personal Printer	DM	105 cps	$299	9	19	376	
Digital Equipment Corp.	LA75 Plus Companion	DM	140 cps	$549	11	20	367	518
Digital Equipment Corp.	LA 210	DM	138 cps	$1,549	3	23	213	
Digital Equipment Corp.	LA424 Multiprinter	DM	178 cps	$1,349	11	20	367	518
Digital Equipment Corp.	DECmultiJET 2000	IJ	79 cps	$539	11	20	304	532
E								
Eastman Kodak	Diconix Color 4 Printer	IJ	64 cps	$895	10	20	374	
Eastman Kodak	Diconix 180si Printer	IJ	68 cps	$399	11	14	357	
Eastman Kodak	Diconix 701 Printer	IJ	60 cps	$549	11	14	357	
Eastman Kodak	Ektaplus 7008	L	7.4 ppm	$1,395	10	20	177	
Eastman Kodak	Ektaplus 7016 PS	L	14.7 ppm	$5,795	10	20	276	
Epson	Action Laser II	L	6 ppm	$999	11	20	164	496
Epson	ActionPrinter 3250	DM	49 cps	$299	11	20	373	519
Epson	DFX-5000	DM	307 cps	$2,199	7	18	267	
Epson	■ DFX-8000	DM	264 cps	$3,699	9	19	380	
Epson	EPL-7500	L	5.9 ppm	$2,999	10	20	181	
Epson	EPL-8000	L	9.9 ppm	$1,999	11	20	164	496
Epson	FX-850	DM	138 cps	$499	7	18	267	
Epson	■ FX-1050	DM	141 cps	$699	8	19	260	
Epson	■ LQ-1170	DM	140 cps	$1,049	10	20	441	
Epson	LQ-2550	DM	105 cps	$1,499	8	19	362	
Epson	■ LQ-570	DM	103 cps	$499	10	20	441	
Epson	LQ-860	DM	128 cps	$949	9	19	383	
Epson	■ LQ-870	DM	141 cps	$749	10	20	441	
Epson	■ LX-810	DM	94 cps	$269	8	19	266	
Everex Systems	LaserScript LX PostScript Laser	L	6 ppm	$1,995	10	20	187	
F								
Facit	B1200*	DM	74 cps	$307	9	19	384	
Facit	B3100*	DM	149 cps	$792	6	19	284	
Facit	B3550C*	DM	181 cps	$1,479	8	19	363	
Fujitsu	DL1200 PC PrintPartner	DM	101 cps	$649	11	20	374	520
Fujitsu	DL3600	DM	154 cps	$799	10	20	444	
Fujitsu	■ DL5800	DM	213 cps	$1,995	11	20	374	520
Fujitsu	■ Print Partner 10	L	10.1 ppm	$1,995	11	20	164	497
G								
GCC Technologies	BLP II	L	4.2 ppm	$1,799	10	20	191	
GCC Technologies	BLP IIS	L	7.9 ppm	$2,599	10	20	191	
General Parametrics	Spectra*Star 430	CTT	0.8 ppm	$6,995	10	20	336	
Genicom	1040	DM	103 cps	$1,799	8	19	368	
Genicom	3320 Quiet	DM	144 cps	$2,146	4	19	166	
Genicom	3410XLQ	DM	150 cps	$2,375	8	19	273	
Genicom	■ 3840E	DM	212 cps	$2,595	10	20	445	
Genicom	4440 XT	DM	326 ppm	$7,795	11	20	375	521
Genicom	Model 7170	L	14.7 ppm	$4,495	11	20	241	509
H								
Hewlett-Packard	■ DeskJet 500	IJ	62 cps	$599	9	19	290	
Hewlett-Packard	DeskJet 500C	IJ	81 cps	$779	11	20	309	531
Hewlett-Packard	■ DeskJet 550C	IJ	78 cps	$1,099	11	20	309	531
Hewlett-Packard	LaserJet IIP Plus	L	4 ppm	$1,249	11	20	170	485
Hewlett-Packard	■ LaserJet IIID	L	7.6 ppm	$3,595	9	19	184	
Hewlett-Packard	■ LaserJet IIIP	L	4 ppm	$1,595	10	20	192	
Hewlett-Packard	■ LaserJet IIISi	L	14.6 ppm	$5,495	10	20	289	
Hewlett-Packard	■ LaserJet 4	L	7.9 ppm	$2,199	11	20	170	485
Hewlett-Packard	■ LaserJet 4M	L	7.9 ppm	$2,999	11	20	170	485
Hewlett-Packard	PaintJet	IJ	78 cps	$1,095	6	19	297	
Hewlett-Packard	PaintJet XL	IJ	65 cps	$2,595	9	19	290	
Hewlett-Packard	■ PaintJet XL300	IJ	19 cps	$3,495	11	20	309	531
Hewlett-Packard	RuggedWriter	DM	173 cps	$1,895	7	18	280	
Hewlett-Packard	ThinkJet	IJ	70 cps	$595	3	23	172	

■=Editors' Choice, C=color, DM=dot matrix, DS=dye sublimation, DW=daisy wheel, IJ=ink jet, L=laser, SI=solid ink, TT=thermal transfer

* This machine has been replaced by an upgraded model.

CONTINUES

NORTON ANTIVIRUS NOW PROVIDES SEVERAL LINES OF DEFENSE.

As long as PC viruses exist, Peter Norton will keep up the fight.

In the battle against today's PC viruses, it's not enough to be tough and comprehensive. For example, the recent Michelangelo virus left everyone scrambling for a cure. And worried about the future.

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But we don't stop there. With Norton AntiVirus, you can dial up our 24-hour on-line bulletin board or CompuServe for an instant update on the latest virus definitions. Or get updates mailed to you on disk with our SAV-U subscription program.

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The goal of most virus hackers is to interrupt your work, if not destroy it. Don't let them win. Get the only protection that stops new viruses as fast as they can make them — Norton AntiVirus 2.1. Just $129* from your dealer. Or call **1-800-554-4403** for an instant FAX Data Sheet (enter 710). To upgrade for $19*, call **1-800-343-4714,** ext. 738.

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CIRCLE 265 ON READER SERVICE CARD

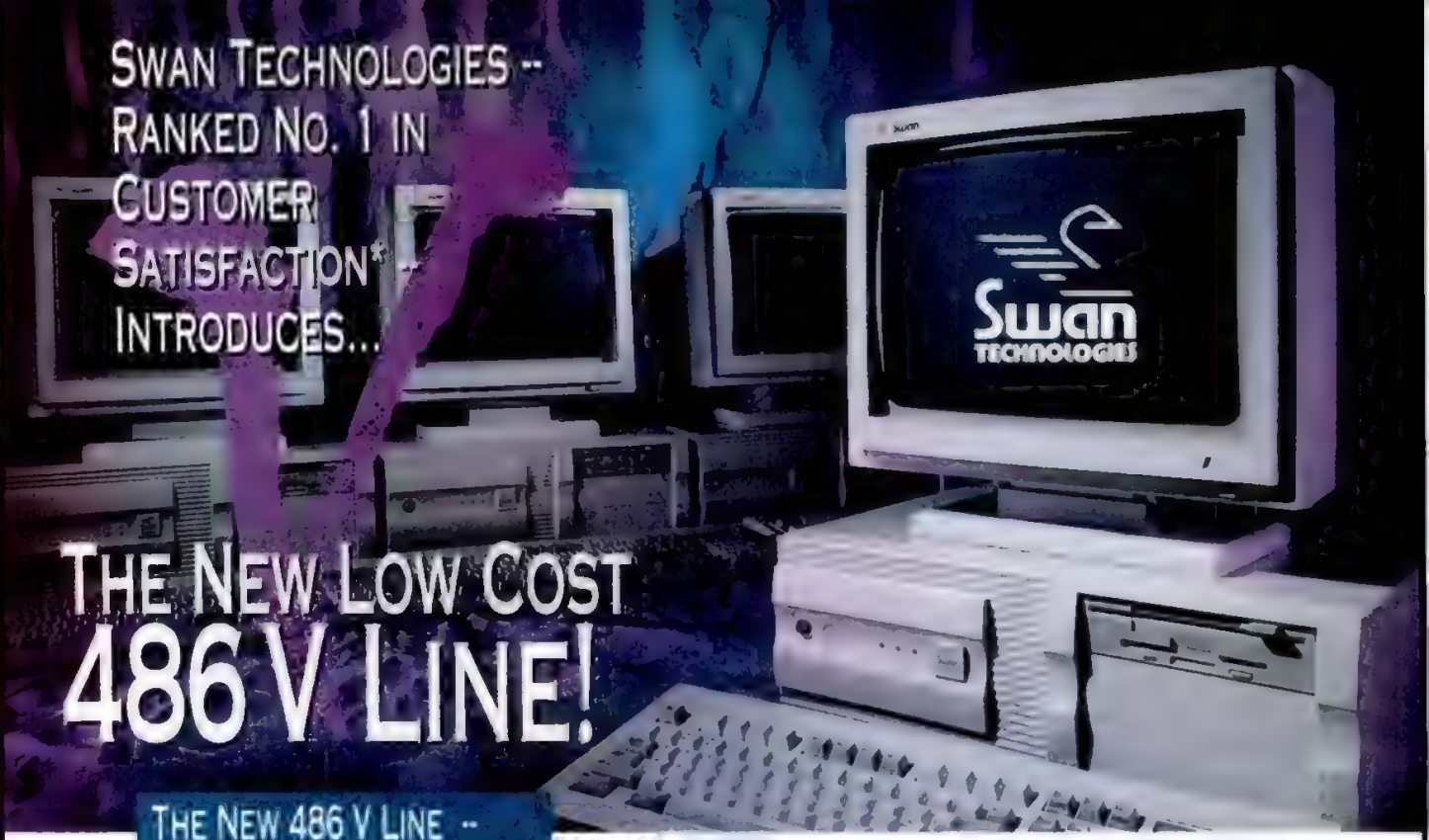
Index to Printer Reviews (1984–1992)

Company name	Product	Type	Speed	Price	Vol.	No.	Pg.	RSN.
K								
Kentek Information Systems	K30D	L	27 ppm	$21,430	11	20	242	534
Kyocera	F-1000A	L	9.4 ppm	$2,895	7	18	152	
Kyocera	■ FS-1500A	L	9.3 ppm	$2,395	11	20	172	486
Kyocera	F-1800A	L	15.2 ppm	$4,495	9	19	195	
Kyocera	F-2010	L	6.8 ppm	$4,295	6	19	188	
Kyocera	F-5000A	L	13.6 ppm	$7,995	10	20	297	
L								
LaserMaster	LM 1000	L	N/A	$5,995	9	19	211	
LaserMaster	TrueTech 800/4	L	3.7 ppm	$3,695	10	20	203	
LaserMaster	TrueTech 1000	L	7.2 ppm	$5,995	10	20	203	
LaserMaster	TrueTech 1200	L	14.9 ppm	$16,995	10	20	307	
LaserMaster	Unity 1000	L	7 ppm	$6,995	11	20	180	487
LaserMaster	Unity 1200xl	L	4.4 ppm	$9,995	11	20	180	487
LaserMaster	WinPrinter 800	L	N/A	$1,595	11	20	180	487
Lexmark (formerly IBM/Lexmark)	■ ExecJet Printer	IJ	198 cps	$1,099	10	20	378	
Lexmark (formerly IBM/Lexmark)	LaserPrinter 4019	L	8.9 ppm	$2,125	8	19	156	
Lexmark (formerly IBM/Lexmark)	LaserPrinter 5e	L	4.5 ppm	$1,595	10	20	194	
Lexmark (formerly IBM/Lexmark)	LaserPrinter 6	L	5.7 ppm	$1,895	10	20	194	
Lexmark (formerly IBM/Lexmark)	LaserPrinter 6P	L	5.8 ppm	$2,295	11	20	182	488
Lexmark (formerly IBM/Lexmark)	■ LaserPrinter 10	L	9.1 ppm	$2,395	10	20	194	
Lexmark (formerly IBM/Lexmark)	LaserPrinter 10L	L	8.9 ppm	$2,995	10	20	292	
Lexmark (formerly IBM/Lexmark)	■ LaserPrinter 10P	L	9.1 ppm	$3,795	11	20	182	488
Lexmark (formerly IBM/Lexmark)	LaserPrinter 4019E	L	4.8 ppm	$999	9	19	190	
Lexmark (formerly IBM/Lexmark)	Personal Printer Series II 2380	DM	153 cps	$499	10	20	448	
Lexmark (formerly IBM/Lexmark)	Personal Printer Series II 2381	DM	162 cps	$699	10	20	448	
Lexmark (formerly IBM/Lexmark)	Personal Printer Series II 2390	DM	112 cps	$499	10	20	448	
Lexmark (formerly IBM/Lexmark)	Personal Printer Series II 2391	DM	120 cps	$699	10	20	448	
Lexmark (formerly IBM/Lexmark)	■ 4226 Printer	DM	229 cps	$2,295	10	20	448	
M								
Mannesmann Tally	MT 150/9	DM	150 cps	$699	11	20	386	522
Mannesmann Tally	MT 151/9	DM	151 cps	$749	11	20	386	522
Mannesmann Tally	MT 150/24	DM	156 cps	$899	11	20	386	522
Mannesmann Tally	MT 151/24	DM	159 cps	$999	11	20	386	522
Mannesmann Tally	■ MT661	DM	467 cps	$6,999	10	20	455	
Mannesmann Tally	MT735	L	6.3 ppm	$999	10	20	206	
Mannesmann Tally	MT911 PS	L	9 ppm	$3,195	10	20	206	
Mannesmann Tally	MT908	L	7.6 ppm	$1,995	11	20	162	495
Mannesmann Tally	130/9	DM	131 cps	$699	9	19	401	
Mannesmann Tally	130/24	DM	128 cps	$899	9	19	402	
Mannesmann Tally	131/9	DM	120 cps	$799	9	19	401	
Mannesmann Tally	131/24	DM	127 cps	$999	9	19	402	
Mannesmann Tally	330	DM	190 cps	$2,349	6	19	320	
Mannesmann Tally	645	DM	313 cps	$5,999	9	19	342	
Mannesmann Tally	81	DM	73 cps	$259	8	19	298	
Microtek Lab	TrueLaser	L	6.1 ppm	$1,995	10	20	227	
Mitek Systems	130TE	L	7.5 ppm	$6,850	9	19	199	
Mitsubishi	DiamondColor Print 300PS	CDS	0.1 gppm	$17,995	11	20	274	472
Mitsubishi	CHC-S446i ColorStream/DS	CDS	0.2 gppm	$11,900	11	20	279	473
N								
NCR	6417-0101	DM	162 cps	$600	9	19	406	
NCR	6436-0301*	L	12.4 ppm	$6,795	10	20	308	
NEC	Colormate PS Model 40	CTT	1.8 ppm	$5,975	10	20	338	
NEC	Pinwriter P3200	DM	104 cps	$342	10	20	456	
NEC	Pinwriter P3300	DM	102 cps	$497	10	20	456	
NEC	■ Pinwriter P6200	DM	144 cps	$621	9	19	407	
NEC	■ Pinwriter P6300	DM	146 cps	$945	9	19	407	
NEC	Pinwriter P9300	DM	162 cps	$1,326	10	20	456	
NEC	■ Silentwriter 95	L	6 ppm	$1,749	11	20	196	489
NEC	■ Silentwriter2 90	L	5.8 ppm	$2,373	9	19	205	
NEC	Silentwriter2 990	L	7.5 ppm	$3,734	10	20	229	

■=Editors' Choice, C=color, DM=dot matrix, DS=dye sublimation, DW=daisy wheel, IJ=ink jet, L=laser, SI=solid ink, TT=thermal transfer

* This machine has been replaced by an upgraded model. N/A—Not applicable: This Windows printer could not perform our Text Speed test.

CONTINUES



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*PC Magazine, Service and Reliability Survey - September 11, 1990
Government Computer News, Product Preference Survey - January 20, 1992

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This workbook-style planner lets you look objectively at your individual needs and the full range of systems, their relative costs and features -- then helps you decide on the very best PC value to suit your needs!

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- ❑ **Commercial/Business**

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3. Types of equipment acquisition planned in next 12 months. _____

Are you planning to make a buying decision in the next 90 days? _____

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As you page through this publication you'll see a number of other low cost lines being advertised. And you'll probably find only a few dollars difference either way from one to the next. So how do you determine which is the best value for you?

We suggest you take a close look at two things: The first involves defining the advertising rhetoric. Take words like 'quality' and 'reliability'-- and put them into real terms.

Here's how Swan V Line customers will define quality and reliability:

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- **Top Quality Components** -- It's precisely because we use only top-shelf components that we can afford to offer our two-year warranty Free. We're betting you'll never need it!

- **Lifetime Technical Support** -- When you have a question, we're there for you. You'll talk to one of the most knowledgeable people in the business. *PC Magazine* calls it, "Swan's remarkable support system".

- **30-Day Money Back Guarantee** -- If you're not completely satisfied with your new V Line system, return it within 30 days for a complete refund!

- **Engineered and Built Right Here At Swan** -- Our new V Line Systems are assembled by the same technicians, in the same quality-oriented environment as our other Swan Systems, so you get reliability you can bank on.

- **Custom Configurations** -- Our competition offers a "take it, or leave it" low cost system -- not Swan! You get the freedom to design your system to suit your specific needs!

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Index to Printer Reviews (1984–1992)

Company name	Product	Type	Speed	Price	Vol.	No.	Pg.	RSN.
NewGen	TurboPS/300p	L	3.8 ppm	$1,995	11	20	205	490
NewGen	TurboPS/400p	L	3.9 ppm	$2,595	11	20	205	490
NewGen	TurboPS/630En	L	7.3 ppm	$3,995	11	20	205	490
NewGen	TurboPS/660	L	7.1 ppm	$3,795	11	20	205	490
NewGen	TurboPS/840	L	7.2 ppm	$5,495	11	20	205	490
NewGen	TurboPS/880	L	7.2 ppm	$5,495	11	20	205	490
NewGen	TurboPS/1200T	L	9 ppm	$14,994	11	20	244	535
O								
Océ Graphics	G5241-PS	CTT	1.2 ppm	$7,990	10	20	343	
OCTuS Inc.	LaserPro 1510	L	13.5 ppm	$5,795	7	18	156	
OCTuS Inc.	LaserPro 810	L	7.5 ppm	$3,495	5	19	292	
Okidata	MicroLine 184 Turbo	DM	117 cps	$359	11	20	395	523
Okidata	■ Microline 320	DM	164 cps	$499	7	18	300	
Okidata	■ Microline 321	DM	157 cps	$699	7	18	300	
Okidata	Microline 380	DM	89 cps	$349	9	19	414	
Okidata	Microline 393 Plus	DM	167 cps	$1,499	9	19	420	
Okidata	Microline 393C	DM	163 cps	$1,599	7	18	302	
Okidata	OL400	L	4.1 ppm	$1,099	9	19	224	
Okidata	OL810	L	8 ppm	$1,699	11	20	207	491
Okidata	■ OL830	L	7.9 ppm	$1,999	10	20	232	
Okidata	OL840	L	7.7 ppm	$2,599	9	19	227	
Okidata	PaceMark 3410	DM	226 cps	$1,999	11	20	395	523
Output Technology Corp.	560DL	DM	147 cps	$1,895	8	19	301	
Output Technology Corp.	DuraLine	DM	217 cps	$2,595	10	20	465	
Output Technology Corp.	Euroline 400	DM	365 lpm	$6,995	11	20	396	524
Output Technology Corp.	■ Euroline 600	DM	477 lpm	$5,495	11	20	396	524
Output Technology Corp.	LaserMatrix 1000 Model 5	L	14.1 ppm	$5,695	11	20	245	536
Output Technology Corp.	TriMatrix 850XL	DM	307 cps	$2,095	6	19	330	
P								
Panasonic	KX-P1123	DM	92 cps	$349.95	10	20	466	
Panasonic	KX-P1124i	DM	107 cps	$499.95	10	20	466	
Panasonic	KX-P1180i	DM	59 cps	$269.95	8	19	303	
Panasonic	KX-P1624	DM	96 cps	$599.95	9	19	428	
Panasonic	KX-P2180	DM	89 cps	$299.95	11	20	399	525
Panasonic	KX-P2123	DM	91 cps	$419.95	11	20	399	525
Panasonic	■ KX-P2124	DM	116 cps	$549.95	11	20	399	525
Panasonic	■ KX-P2624	DM	111 cps	$649.95	10	20	466	
Panasonic	KX-P4410	L	4.5 ppm	$1,095	11	20	207	498
Panasonic	KX-P4430	L	4.7 ppm	$1,495	11	20	207	498
Panasonic	KX-P4450i Laser Partner	L	10.2 ppm	$2,095	9	19	236	
Panasonic	KX-P4455 Laser Partner	L	10.2 ppm	$2,995	10	20	236	
Primages	Primage 90-GT	DW	56 cps	$1,500	6	19	386	
Printek	FormsPro 2000	DM	111 cps	$2,095	5	19	247	
Printronix	L1016	L	14.8 ppm	$6,995	11	20	247	537
Printronix	L2324 Page Printer	L	20.9 ppm	$14,495	8	19	167	
Printronix	P3240	DM	122 cps	$6,195	10	20	470	
Printware	720 IQ Professional-II	L	7.5 ppm	$7,990	9	19	240	
Printware	Printware Pro-III	L	8.5 ppm	$15,990	10	20	311	
Q								
QMS	■ ColorScript 100 Model 10	CTT	2.8 ppm	$6,995	8	19	217	
QMS	ColorScript 100 Model 10p	CTT	1.2 ppm	$5,995	10	20	347	
QMS	ColorScript 100 Model 30si	CTT	0.5 gppm	$9,995	11	20	281	474
QMS	PS-410	L	3.6 ppm	$1,995	9	19	251	
QMS	PS-815	L	7.5 ppm	$3,295	10	20	240	
QMS	PS-815 MR	L	7.3 ppm	$3,995	10	20	240	
QMS	PS-825	L	7.4 ppm	$3,995	10	20	240	
QMS	PS-1700	L	14.7 ppm	$6,995	11	20	248	538
QMS	■ PS-2000	L	17.2 ppm	$12,995	10	20	314	
QMS	■ PS-2210	L	17.3 ppm	$5,795	9	19	256	
Qume	CrystalPrint Express	L	2.6 ppm	$3,495	9	19	242	
Qume	CrystalPrint Publisher II	L	5.2 ppm	$2,995	9	19	245	
Qume	Sprint 11/55 Plus	DW	54 cps	$2,498	3	23	340	

■=Editors' Choice, C=color, DM=dot matrix, DS=dye sublimation, DW=daisy wheel, IJ=ink jet, L=laser, SI=solid ink, TT=thermal transfer

CONTINUES

Index to Printer Reviews (1984–1992)

Company name	Product	Type	Speed	Price	Vol.	No.	Pg.	RSN.
R								
Royal	CJP 450	IJ	62 cps	$499.95	11	20	314	533
S								
Samsung Electronics America	Finalé 8000	L	7.5 ppm	$1,995	11	20	208	499
Seiko	ColorPoint PSX Model 4	CTT	0.9 ppm	$7,999	10	20	352	
Seiko	ColorPoint PSX Model 14	CTT	0.6 ppm	$11,999	10	20	352	
Seikosha	BP 5780	DM	221 cps	$2,200	10	20	471	
Seikosha	LT 20	DM	23 cps	$499	10	20	471	
Seikosha	SBP-10 Plus	DM	314 cps	$4,495	7	18	309	
Seikosha	SK-3005 Plus	DM	170 cps	$854	6	19	349	
Seikosha	SL-90 Plus	DM	63 cps	$549	9	19	429	
Seikosha	SL-230AI*	DM	77 cps	$998	8	19	307	
Seikosha	SP-2000*	DM	86 cps	$329	9	19	429	
Seikosha	SP-2400	DM	96 cps	$329	11	20	400	526
Seikosha	SP-2415	DM	94 cps	$549	11	20	400	526
Sharp	JX-9500H	L	8.5 ppm	$995	10	20	252	
Sharp	JX-9700	L	14.4 ppm	$2,295	10	20	317	
Star Micronics	StarJet SJ-48	IJ	38 cps	$499	10	20	378	
Star Micronics	LaserPrinter 4	L	4 ppm	$1,395	10	20	254	
Star Micronics	LaserPrinter 4 StarScript	L	4 ppm	$1,995	10	20	254	
Star Micronics	NX-1001 Multi-Font	DM	97 cps	$229	10	20	472	
Star Micronics	NX-1020 Rainbow	DM	96 cps	$299	10	20	472	
Star Micronics	NX-1500 Multi-Font	DM	91 cps	$499	9	19	430	
Star Micronics	NX-2415 Multi-Font	DM	100 cps	$599	9	19	436	
Star Micronics	NX-2430 Multi-Font	DM	90 cps	$399	11	20	400	527
Star Micronics	NX-2420 Rainbow	DM	90 cps	$499	10	20	472	
Star Micronics	XB-2420 Multi-Font	DM	136 cps	$749	10	20	472	
Star Micronics	XB-2425 Multi-Font	DM	135 cps	$949	10	20	472	
Star Micronics	XR-1020 Multi-Font	DM	137 cps	$549	10	20	472	
Star Micronics	XR-1520 Multi-Font	DM	137 cps	$699	10	20	472	
Synergystex International Inc.	CF1000 Continuous Form Laser Printer	L	14.7 ppm	$4,995	11	20	224	504
T								
Tandy	DMP 136	DM	108 cps	$249.95	10	20	478	
Tandy	DMP 240	DM	98 cps	$399.95	9	19	441	
Tandy	DMP 310 Slimline	DM	43 cps	$499.95	11	20	402	528
Tandy	DMP 2130	DM	108 cps	$899	9	19	438	
Tektronix	Phaser IIsd	CDS	0.2 gppm	$9,995	11	20	282	476
Tektronix	Phaser II PXe	CTT	0.6 gppm	$4,995	11	20	282	475
Tektronix	Phaser II PXi	CTT	1.2 ppm	$7,995	10	20	357	
Tektronix	Phaser III PXi	CSI	0.2 gppm	$9,995	11	20	282	477
Texas Instruments	880 AT	DM	172 cps	$2,195	5	19	252	
Texas Instruments	885	DM	195 cps	$2,295	6	19	365	
Texas Instruments	8930	DM	174 cps	$2,545	9	19	441	
Texas Instruments	microLaser*	L	6.3 ppm	$999	9	19	258	
Texas Instruments	microLaser Turbo	L	8.3 ppm	$1,749	11	20	208	500
Texas Instruments	microLaser XL Turbo	L	14.5 ppm	$3,649	11	20	249	539
Texas Instruments	microLaser XL PS35	L	14.7 ppm	$3,149	10	20	320	
Toshiba America Information Systems	ExpressWriter 201	DM	18 cps	$499	11	14	367	
Toshiba America Information Systems	PageLaser GX200	L	7.6 ppm	$1,799	11	20	211	501
Toshiba America Information Systems	PageLaser GX400	L	14.8 ppm	$4,499	11	20	241	510
U								
Unisys	AP 1324	DM	117 cps	$1,695	8	19	319	
Unisys	AP 1371	DM	281 cps	$3,295	11	20	402	529
Unisys	AP 9215-1	L	13.4 ppm	$5,995	8	19	190	
U.S. Laser Corp.	EiconLaser*	L	7.3 ppm	$5,595	10	20	180	
V								
Varityper	VT600P*	L	7.9 ppm	$9,995	8	19	197	
X								
Xante Corp.	Accel-a-Writer 8000	L	7.7 ppm	$3,295	11	20	211	502

■=Editors' Choice, C=color, DM=dot matrix, DS=dye sublimation, DW=daisy wheel, IJ=ink jet, L=laser, SI=solid ink, TT=thermal transfer

* This machine has been replaced by an upgraded model

ENDS

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crisp and bright screen... Windows, July 1992.

"BREATHTAKING"

beauty is NEC's UltraLite SL/25C... PC Laptop Computers, July 1992.

"IDEAL"

for Windows and graphics programs... Laptop Buyer's Guide & Handbook, July 1992.

"SPECTACULAR"

color... PC Magazine, January 14, 1992.

"FASTEST"

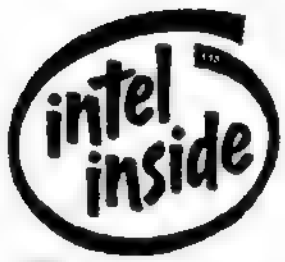
machine we tested... PC World, September 1992.

"OUTSTANDING"

ultra-quiet keyboard... Windows, July 1992.

"SUPERB"

color screen and fast hard disk... PC Magazine, January 14, 1992.



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UTILITIES

CDPLAYER Makes Your CD-ROM Drive Sing

BY JEFF PROSISE

Have you ever wondered what it takes to play an audio CD in a CD-ROM drive? I did, and it sent me on a search for the perfect utility to transform my PC's CD-ROM into a stereo CD player. A stroll through CompuServe turned up at least half a dozen possibilities, but none were exactly what I wanted—so I wrote my own. Besides adding a useful capability to my PC, this exercise gave me a chance to experiment with the new Media Control Interface (MCI) in Windows 3.1 which, among other functions, places a high-level communications layer between Windows programs and multimedia devices such as compact disk players.

If you run Microsoft Windows 3.1 (or 3.0 with Multimedia Extensions) and use an audio-capable CD-ROM drive, this issue's utility—CDPLAYER—should interest you. With it, you can play audio disks in a CD-ROM drive and control track selections as you would on a conventional CD player.

You can download CDPLAYER from the Utilities/Tips Forum on PC MagNet as explained in the sidebar "Utilities by Modem." If you just want the program, download CDPLAY.EXE. CDPLAY.ZIP contains the executable file as well as CDPLAYER.C (the C source code), CDPLAYER (the make file), CDPLAYER.DEF (the module definition file), CDPLAYER.RC (the resource script), and CDPLAYER.H (the C header file). If you don't have a modem, you can get the program on-disk directly from *PC Magazine*. Either send a postcard with your name, address, and preferred disk size to the attention of Katherine West, Utilities, *PC Magazine*, One Park Ave., New York, NY 10016, or fax your request to 212-503-5799. No phone calls, please.

USING CDPLAYER In order to assign a device letter to a CD-ROM drive, DOS requires MSCDEX (Microsoft's CD-ROM extensions), which—if you use your drive to read data disks—is probably already loaded. If not, add it to your AUTOEXEC.BAT file or run it from the command line prior to starting Windows. If you don't have the latest MSCDEX release (which is Version 2.21 as of this writing), you can download it from the Microsoft Software Library on CompuServe. Type GO CIS:MSL to get there, then download CDEXT.EXE (a self-extracting archive).

Want to get double duty out of your CD-ROM drive? This issue's utility exploits Windows' Media Control Interface to turn your CD-ROM drive into an audio CD player.

You must also install Windows' CD Audio driver, MCICDA.DRV, before using CDPLAYER. To find out if it's already in place, start the Control Panel, open the Drivers applet and look through the Installed Drivers list box. If "[MCI] CD Audio" doesn't appear, install it by pressing the Add button and selecting "[MCI] CD Audio." Click OK, then follow the on-screen instructions. Windows may request one of its distribution disks, so have the originals handy. When you're done, restart Windows.

The easiest way to make CDPLAYER accessible is by setting up a program item for it in a Program Manager group. You may prefer, though, to add the item to the Startup group so CDPLAYER will load every time Windows does. In any case, when the utility runs, you'll see a window similar to that shown in Figure 1.

The numbered buttons in the window's upper-left corner function just like those on a real CD player—whichever you press causes play to begin at that track. CDPLAYER only enables buttons that correspond to existing tracks. If a CD contains 14 tracks, for example, buttons 1 through 14 will be valid. The rest will be grayed out. With no CD in the drive, all 20 buttons will be disabled.

The 20+ button in the lower-left quadrant of the window lets you select track numbers higher than 20. Press it once and the track-button numbers change from their usual 1 through 20 to 21 through 40. Select it again and the numbers return to 1 through 20 if the CD contains 40 or fewer tracks; they turn into 41 through 60 for CDs containing more than 40 tracks. CDPLAYER supports up to 99 tracks per CD, the maximum that the MCICDA driver allows. The 20+ button will only be enabled if a CD in the drive contains more than 20 tracks.

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Utilities by Modem

The *PC Magazine* utilities are available by modem from PC MagNet, a ZiffNet service hosted by CompuServe.

To find the phone number nearest you, set your communications software to 300, 1,200, 2,400, or 9,600 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex, then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you. Or you can call 800-635-6225 (voice) and follow the instructions and note the number.

To obtain the current issue's utility free of charge, simply dial the local number; at the HOST NAME prompt, type CIS; and at the USER ID prompt, enter 60116,1. Then at the PASSWORD prompt, enter PCMAGUTIL.

To join ZiffNet, at the USER ID prompt type 177000,5000. Then, at the PASSWORD prompt, enter PC* MAGNET. Finally, at the ENTER AGREEMENT NUMBER prompt, type PCMAG92.

Register your name and enter your American Express, MasterCard, or Visa number. (If you'd like to have your company billed instead, call CompuServe at 800-848-8990.) Your personal user ID and a temporary password will be displayed. A new password will arrive in the mail within ten days to confirm your subscription.

ZiffNet membership costs $2.50 per month. This includes access to *PC Magazine* Editors' Choice awards, Product Reviews Index, Weekly News from *PC Week*, Buyers' Market, ZiffNet Highlights, and the Support Forum (which also includes the current utility). CompuServe members can join by entering GO PCMAG at any CompuServe ! prompt.

Outside of these areas, PC MagNet costs $6.30 per hour for 300-bps service, $12.80 for 1,200- or 2,400-bps service, and $22.80 for 9,600-bps. Billing is based on 1-minute increments.

These programs can be copied but are copyrighted. You may make copies for others as long as no charge is involved, but making copies for any commercial purpose is prohibited. □

The buttons in the upper-right corner of the window also work like those on a real CD player. The Play button begins playback at track 1, Stop halts it, Pause suspends it, and Eject ejects the CD (provided your CD-ROM drive supports a software eject command; not all of them do). The button labeled "¦<<" goes to the previous track, while ">>¦" advances to the next, furnishing a quick way to replay or skip a track. Once started, play proceeds unless interrupted by a press of the Stop, Pause, or Eject keys. The Continuous Play check box, if marked, causes CDPLAYER to repeat the entire CD (from the first track) every time it reaches the end, until the box is no longer checked or the program terminates. If the box is unchecked, play ceases after the final track.

The controls in the lower-right corner of the window show the status of the current track: Track displays the track's number, Length gives its duration (in minutes and seconds), and Time shows how long the track has played (again, in minutes and seconds). The scroll-bar thumb also reflects progress through the track being played by moving to the right. Likewise, you can select a new position in the current track by either sliding the scroll-bar thumb directly or pressing the left or right arrows appearing at opposite ends of the bar. The utility updates both the Time indicator and scroll bar every second.

The Close button terminates CDPLAYER, but a currently playing CD will finish. If you want play to halt when you close the application, press Stop first.

The window's appearance always tells you the status of the CD-ROM drive. If all track buttons are grayed out (disabled), there is no CD in the drive. If one or more buttons are enabled but Track, Length, and Time are blank, then there is a CD in the drive but it's not playing. Pressing Play or a numbered button will start the audio. When the Track, Length, and Time indicators are lit but Time and the scroll bar are frozen, the CD is paused. Press Pause again to resume. Finally, a changing Time indicator and moving scroll-bar thumb mean that a CD is currently playing.

THE MINIMIZE TIME SLICE OPTION CDPLAYER can adversely affect performance on some systems. Once a second, CDPLAYER pauses and sends a series of commands to the MCICDA driver to determine the drive's status. This information is used to update CDPLAYER's display. Some CD-ROM drives respond to these commands quickly, minimizing the impact that the momentary delay has on the rest of the system. Others, though, take several tenths of a second to respond, slowing operation to a crawl. If you encounter this problem, select the Minimize Time Slice option in CDPLAYER's system menu, then keep the utility iconized when not in use. Used in this manner, CDPLAYER should affect the performance of other programs very little if at all. There's only one drawback to using this option: When you restore the window to full size, the status indicators in its lower right quadrant will be incorrect for a split second.

ERROR MESSAGES CDPLAYER can give two possible error messages on start-up. One, "Unable to open the CD Audio device," means that Windows failed to open MCICDA.DRV as requested by the program. This occurs if MCICDA

Figure 1: **The CDPLAYER window, which resembles the front panel of an audio CD player.**

isn't loaded, is being used in nonshareable mode by another Windows program, or if MSCDEX is missing. If MCICDA needs to be installed, follow the instructions in the section "Using CDPLAYER" above. If the problem stems from another application refusing to share the driver, you'll have to close the offending program before you can start CDPLAYER.

If [MCI] CD Audio shows up in the installed drivers list but CDPLAYER still insists it can't open the CD Audio device, make sure your AUTOEXEC.BAT loads MSCDEX each time you boot.

The second error message you may encounter is "Unable to allocate a timer." CDPLAYER updates its status indicators once a second with the aid of a *timer*—a special Windows resource that messages a Windows program at specified intervals, allowing it to perform some action in a regularly scheduled manner. Normally, Windows has plenty of timers to go around (16 in Version 3.0, 32 in 3.1). In the unlikely event that you exceed the limit, Windows can't allocate a timer until a program using one terminates. If you receive this message, close one or more applications and try again.

Certain actions in Word for Windows 2.0—selecting Open or Save As from the File menu, for example—may stop the currently playing CD. The problem stems from a bug in WinWord that Microsoft fixed in Version 2.0a. Registered users of the earlier release can call the company for a free upgrade.

A DIALOG BOX OR WINDOW? Many Windows programs start off by filling in the fields of a WNDCLASS structure, calling RegisterClass to register the new window class, and then calling CreateWindow to create a window based on that class. If you examine the WinMain function shown in Figure 2, you'll notice that CDPLAYER is slightly different. To create its main window, CDPLAYER calls CreateDialog rather than CreateWindow. CreateDialog is the Windows function that makes a modeless dialog box. You can't tell that CDPLAYER's window is a modeless dialog box because it behaves just like a regular window.

CreateDialog uses a dialog box template stored in the program's .EXE file to construct and position the child controls inside the window. If you created the main window without using a dialog box template, you would need an additional 30 or so calls to CreateWindow to build the same controls. The only difference between the window procedure that services CDPLAYER and a "normal" window procedure is that CDPLAYERS's window procedure passes unprocessed messages to DefDlgProc rather than DefWindowProc. This is proper etiquette for a dialog box that supplies its own window procedure, because dialog boxes respond differently to some messages than conventional windows do.

The CDPLAYER window is based on the template in CDPLAYER.RC (not shown here, but available on PC MagNet). The only difference between this and a conventional dialog box template is the use of a CLASS statement to assign the class name CDPLAYER to the window. Omit this statement (as most dialog box templates do) and Windows itself will handle messages to the window using an internal window procedure created for dialog boxes. Including this statement directs Windows to send messages to the window procedure specified in the WNDCLASS structure.

After creating the main window, CDPLAYER places a call to Windows to open the CD Audio driver. If successful, the program initializes the driver to use the TMSF (track, minute, second, frame) time format. The time format determines how the CD Audio driver presents time values used as input and output parameters. For example, when you query the drive to determine the current position of the play head, Windows returns a 32-bit value. In TMSF format, the bytes—from least to most significant—denote the track number, minutes, seconds and frames. One frame equals 1/75 of a second.

Windows' CD Audio driver supports three time formats: milliseconds, TMSF, and MSF (minutes, seconds, frames). MMSYSTEM.H (the C header file that contains prototypes for MCI functions and macros) includes a convenient set of macros to help you go from TMSF values to tracks, minutes, seconds, and frames and vice versa. CDPLAYER uses some of these macros. MCI_MAKE_TMSF, for example, forms a TMSF value that specifies the new track position when you slide the scroll-bar thumb.

After opening and initializing the CD Audio device, CDPLAYER uses the Windows function GetDlgItem to obtain the handles of four child windows for later use. The four child windows are the

PC Magazine Utilities Updates

As with all good software, the programs presented in *PC Magazine* are periodically upgraded and improved. Here's a partial list of the programs on PC MagNet that have been updated. To download these files from the Utilities/Tips Forum, type GO ZNT:TIPS, type LIB or select Libraries from the menu, then select Library 2 PCMAG UTILS. Type DOW and the filename listed below (for example, DOW ANSI.COM), or select Download a File from the menu.

ADDIT.COM, Version 1.1
ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.5
BCOPY, Version 1.2
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.7
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PCACCESS.EXE, Version 1.1
RN.COM, Version 3.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.4

For a complete list of the programs that are available on PC MagNet, download PCMCAT.ZIP from Library 0 (New Uploads) of the Utilities/Tips Forum.

A downloadable index to *PC Magazine*'s product reviews is also available in Library 1 (General Info). PCM.EXE is a self-extracting file containing the Computer Library *PC Magazine* Reviews Index for January 1988 through December 1991. It requires the search files in PCSRCH.EXE. □

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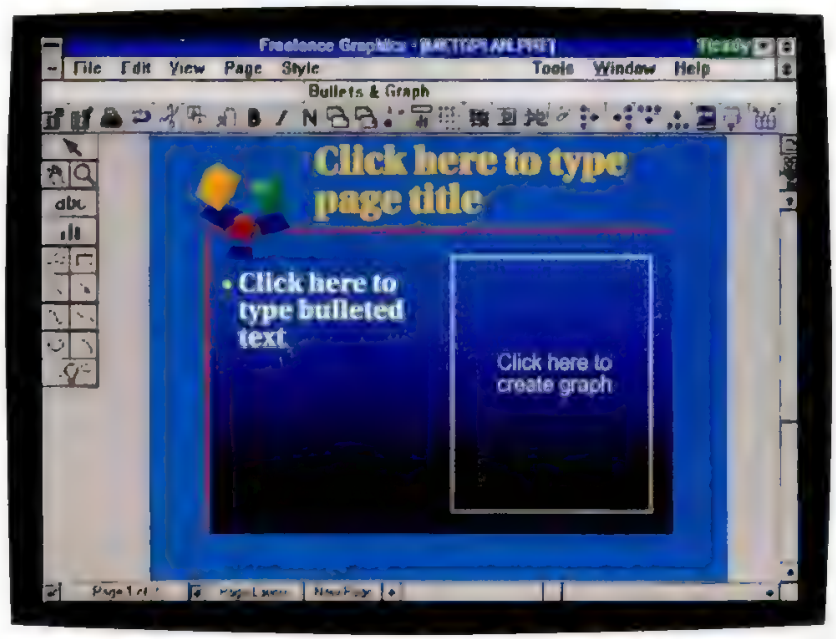

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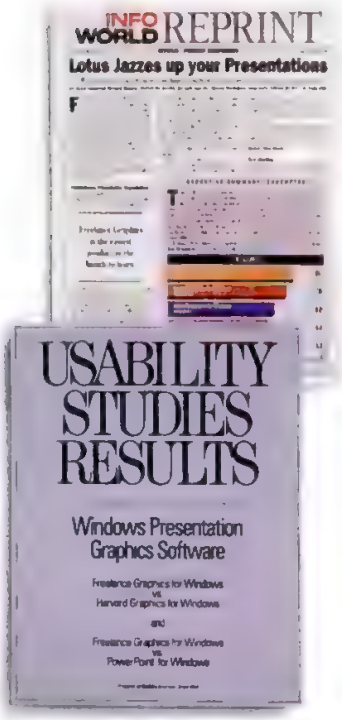

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The WinMain Function

```
int PASCAL WinMain (HANDLE hInstance, HANDLE hPrevInstance,
                    LPSTR lpszCmdLine, int nCmdShow)
{
    static char szOpenError[] = "Unable to open the CD Audio device";
    static char szTimerError[] = "Unable to allocate a timer";
    static char szAppName[] = "CDPlayer";
    WNDCLASS wndclass;
    HWND hwnd;
    MSG msg;

    // Register the window class
    if (!hPrevInstance) {
        wndclass.style = 0;
        wndclass.lpfnWndProc = (WNDPROC) WndProc;
        wndclass.cbClsExtra = 0;
        wndclass.cbWndExtra = DLGWINDOWEXTRA;
        wndclass.hInstance = hInstance;
        wndclass.hIcon = LoadIcon (hInstance, szAppName);
        wndclass.hCursor = LoadCursor (NULL, IDC_ARROW);
        wndclass.hbrBackground = COLOR_WINDOW + 1;
        wndclass.lpszMenuName = NULL;
        wndclass.lpszClassName = szAppName;

        RegisterClass (&wndclass);
    }

    // Create a window based on the registered class
    hwnd = CreateDialog (hInstance, szAppName, 0 , NULL);

    // Open the CD Audio device and set the time format to TMSF
    MCISet.dwTimeFormat = MCI_FORMAT_TMSF;
    MCIOpen.lpstrDeviceType = (LPCSTR) MCI_DEVTYPE_CD_AUDIO;
    if (!mciSendCommand (NULL, MCI_OPEN, MCI_OPEN_TYPE |
        MCI_OPEN_TYPE_ID, (DWORD) (LPSTR) &MCIOpen))
        mciSendCommand (MCIOpen.wDeviceID, MCI_SET,
            MCI_SET_TIME_FORMAT, (DWORD) (LPSTR) &MCISet);
    else if (!mciSendCommand (NULL, MCI_OPEN, MCI_OPEN_TYPE |
        MCI_OPEN_TYPE_ID | MCI_OPEN_SHAREABLE, (DWORD) (LPSTR) &
MCIOpen))
        mciSendCommand (MCIOpen.wDeviceID, MCI_SET,
            MCI_SET_TIME_FORMAT, (DWORD) (LPSTR) &MCISet);
    else {
        MessageBeep (MB_ICONEXCLAMATION);
        MessageBox (
hwnd, szOpenError, "Error", MB_ICONEXCLAMATION | MB_OK);
        return FALSE;
    }

    // Get window handles and font handle
    hwndTrack = GetDlgItem (hwnd, IDD_TRACK);
    hwndLength = GetDlgItem (hwnd, IDD_LENGTH);
    hwndTime = GetDlgItem (hwnd, IDD_TIME);
    hwndScrollBar = GetDlgItem (hwnd, IDD_SCROLLBAR);

    // Allocate a timer that calls WndProc once per second
    if ((wTimerID = SetTimer (hwnd, 1, 1000, NULL)) == NULL) {
        MessageBeep (MB_ICONEXCLAMATION);
        MessageBox (
hwnd, szTimerError, "Error", MB_ICONEXCLAMATION | MB_OK);
        return FALSE;
    }

    // Display the window
    ShowWindow (hwnd, nCmdShow);
    UpdateWindow (hwnd);

    // Enter the message loop
    while (GetMessage (&msg, NULL, 0, 0))
        if ((hwnd == 0) || (!IsDialogMessage (hwnd, &msg)))
            DispatchMessage (&msg);

    // Terminate the program
    return msg.wParam;
}
```

Figure 2: **The WinMain function creates the CDPLAYER window, initializes variables, allocates a timer resource, opens the MCICDA driver, and sets up the program's message loop.**

scroll bar and the three static text controls that display the track number, length, and time. GetDlgItem accepts a window handle (that of the dialog box window that owns the child controls) and a control ID (the integer value uniquely identifying the control) and returns a window handle. CDPLAYER could call GetDlgItem each time it needs a window handle, but since these four handles are used often, it's faster to call GetDlgItem at the beginning of the program and store the handles as variables.

Next, WinMain allocates a timer, setting it up to send a WM_TIMER message to WndProc every 1,000 milliseconds, or once per second. CDPLAYER uses the message to trigger checks of the CD-ROM drive's status and updates of the appropriate on-screen indicators periodically. For example, each time the program gets a WM_TIMER message, it transmits a command to the CD Audio device to determine if a CD is in the drive. If it senses that a new CD has been inserted, CDPLAYER queries the drive for the number of tracks and their length, then lights the corresponding track buttons. We'll examine the processing of the WM_TIMER message in more detail later.

Finally, the WinMain function calls ShowWindow and UpdateWindow to display the CDPLAYER window. Then it creates the message loop indigenous to all Windows programs and terminates the routine when the loop ends due to the receipt of a WM_QUIT message. The only twist comes from the following instructions, which appear between the `while` statement and the call to DispatchMessage:

```
if ((hwnd==0) ||
  (!IsDialogMessage(hwnd, &msg)))
```

Windows programs normally omit this line, since it processes messages having special meaning to a modeless dialog box. Without it, a key such as Tab, which moves the input focus from one control to another in a dialog box, will be ignored.

SENDING MCI COMMANDS All communications with the MCICDA driver are accomplished with Windows' mciSendCommand function, which has the following form:

```
mciSendCommand(wDeviceID, wMessage,
  dwParam1, dwParam2)
```

where wDeviceID holds the ID number of the device to which the command is directed, wMessage contains a command identifier, dwParam1 contains one or more flags that affect the execution of the command, and dwParam2 contains a pointer to a parameter block. Another Windows function, mciSendString, works in a similar manner but accepts high-level commands stored as ASCIIZ strings rather than the low-level data structures used by mciSendCommand. Internally, though, Windows translates mciSendString commands to mciSendCommand's data structures, so choosing this function reduces overhead. The MCICDA driver accepts ten different commands, summarized in Figure 3, which are passed in wMessage to mciSendCommand.

CDPLAYER uses six of the ten supported commands: MCI_OPEN, MCI_CLOSE, MCI_PLAY, MCI_STOP, MCI_SET and MCI_STATUS. MCI_OPEN opens the device and obtains a device ID used for subsequent calls to the MCICDA driver. A call to MCI_CLOSE

just prior to program termination (when the WM_DESTROY message is processed) closes the connection. MCI_PLAY is called to begin play and MCI_STOP is called when Stop or Pause is pressed. Windows' MCICDA driver supports neither pause nor resume (MCI_PAUSE has the same effect as MCI_STOP). CDPLAYER implements the Pause button by saving the current position in the track, stopping play, and restarting it at the saved location when Pause is pressed again.

The MCI_SET command is called once at the beginning of the program to establish TMSF as the time format. The MCI_STATUS command is called several times to return important information about the device and the CD that is inside it.

The following commands, which CDPLAYER uses to determine if a CD is in the drive, typify calls to the MCICDA driver:

```
MCIStatus.dwItem=
 MCI_STATUS_MEDIA_PRESENT;
mciSendCommand (MCIOpen.wDeviceID,
 MCI_STATUS, MCI_STATUS_ITEM|
 MCI_WAIT, (DWORD) (LPSTR)
 &MCIStatus);
```

The subcommand MCI_STATUS_MEDIA_PRESENT, which is defined as 0x00000005L in the MMSYSTEM.H header file, is placed in the dwItem field of the structure named MCIStatus. The structure's type, declared to be MCI_STATUS_PARMS, is defined in the following way in the MMSYSTEM.H header file:

MCICDA CD Audio Commands

Command	Description
MCI_CLOSE	Closes an open CD Audio device.
MCI_GETDEVCAPS	Returns information about the capabilities of the device.
MCI_INFO	Returns a string that describes the CD Audio device.
MCI_OPEN	Opens a CD Audio device.
MCI_PAUSE	For Windows' MCICDA driver, same as MCI_STOP.
MCI_PLAY	Begins play at a specified location on the CD.
MCI_SEEK	Seeks to a specified location on the CD.
MCI_SET	Sets parameters that govern the operation of the device.
MCI_STATUS	Returns information about the status of the device.
MCI_STOP	Stops play.

Figure 3: **Windows' MCICDA driver supports ten software commands. MCI_PAUSE performs the same action as MCI_STOP, so CDPLAYER implements a Pause button by saving the current position of the play head when Pause is pressed and resuming play at the saved position when Pause is pressed again.**

Processing the MM_MCINOTIFY Message

```
case MM_MCINOTIFY:
    // Restart the CD if "Continuous Play" is checked
    if (wParam == MCI_NOTIFY_SUCCESSFUL) {
        if (IsDlgButtonChecked (hwnd, IDD_CHECKBOX) == 1)
            BeginPlay ((BYTE) 1, hwnd);
        else
            wCurrentTrack = 0;
        return 0;
    }
    break;
```

Figure 4: **CDPLAYER receives an MM_MCINOTIFY message when an MCI_PLAY command is completed. If the wParam portion of the message is equal to MCI_NOTIFY_SUCCESSFUL (indicating that CDPLAYER has reached the end of the CD), and if the Continuous Play box is checked, CDPLAYER starts play again at track 1.**

```
typedef struct tagMCI_STATUS_PARMS {
    DWORD dwCallback;
    DWORD dwReturn;
    DWORD dwItem;
    DWORD dwTrack;
} MCI_STATUS_PARMS;
```

Then mciSendCommand is called. The wDeviceID parameter is the value that was returned to the wDeviceID field of a structure called MCIOpen when the device was opened. The wMessage parameter contains the MCI_STATUS command ID and dwParam1 holds a pair of flags. The MCI_STATUS_ITEM flag informs the driver that the dwItem field of the MCIStatus structure contains a subcommand code, while MCI_WAIT instructs the MCICDAdriver not to return from the function call until processing is complete. If you omit this flag, mciSendCommand will return immediately. Finally the dwParam2 parameter contains a far pointer to the MCIStatus structure.

When mciSendCommand returns, the dwReturn field of MCIStatus contains TRUE if a CD is in the drive and FALSE otherwise. This explains the importance of calling MCI_STATUS_MEDIA_PRESENT with an MCI_WAIT flag: If you don't, dwReturn may still be empty when you check it. It is important to use the MCI_WAIT flag when the next operation you perform depends on the outcome of a command; for example, when you ask the drive whether it contains a CD and then branch depending on the outcome.

There are situations, however, in which it is desirable for a command to return immediately. For example, MCI_PLAY commands executed with MCI_WAIT do not return until the specified track or tracks have played through. The system is tied up for the duration, meaning Windows is unable to allocate time slices to other programs. Therefore, you would probably never want to use MCI_PLAY and MCI_WAIT together.

THE MM_MCINOTIFY MESSAGE For another example of CDPLAYER's communications with the MCICDA driver, consider the commands below. Executed by CDPLAYER's BeginPlay function, they initiate playback at the start of the track that byTrackNumber specifies.

```
MCIPlay.dwCall-Back=
 (DWORD) hwnd;

MCIPlay.dwFrom=MCI_MAKE_TMSF
 (byTrackNumber, 0, 0, 1);
mciSendCommand (MCIOpen.wDeviceID,
MCI_PLAY, MCI_FROM|MCI_NOTIFY,
 (DWORD) (LPSTR) &MCIPlay);
```

The dwCallback field of the MCIPlay structure receives a copy of CDPLAYER's window handle. This enables the MCICDA driver to send a message to the proper window procedure when MCI_PLAY has finished executing (more on this in a moment). The structure's dwFrom field specifies the position at which play will begin and is loaded with the TMSF value that the macro MCI_MAKE_TMSF forms from T=by-

Processing the WM_TIMER Message

```
case WM_TIMER:
    // Ignore this message if the window is minimized and
    // Minimize Time Slice is checked in the system menu
    if ((IsIconic (hwnd)) && (GetMenuState (hSysMenu,
        IDM_TOGGLENTS, MF_BYCOMMAND) & MF_CHECKED))
        return 0;

    // Find out if there is a CD in the drive
    MCIStatus.dwItem = MCI_STATUS_MEDIA_PRESENT;
    mciSendCommand (MCIOpen.wDeviceID, MCI_STATUS, MCI_STATUS_ITEM |
        MCI_WAIT, (DWORD) (LPSTR) &MCIStatus);

    // Initialize the program if a CD was inserted
    if (((!bMediaPresent) && (MCIStatus.dwReturn == TRUE)) {
        bMediaPresent = TRUE;
        bScrolling = FALSE;
        bPaused = FALSE;
        wCurrentTrack = 0;
        wPageNumber = 0;

        // Get the number of tracks
        MCIStatus.dwItem = MCI_STATUS_NUMBER_OF_TRACKS;
        mciSendCommand (
MCIOpen.wDeviceID, MCI_STATUS, MCI_STATUS_ITEM |
            MCI_WAIT, (DWORD) (LPSTR) &MCIStatus);
        wNumberOfTracks = (WORD) MCIStatus.dwReturn;
        if (wNumberOfTracks > 99)
            wNumberOfTracks = 99;
        wPageCount = ((wNumberOfTracks - 1) / 20) + 1;

        // Enable the track button display
        if (wNumberOfTracks <= 20)
            for (i=1; i<=wNumberOfTracks; i++)
                EnableWindow (GetDlgItem (hwnd, i+100), TRUE);
        else {
            for (i=1; i<=20; i++)
                EnableWindow (GetDlgItem (hwnd, i+100), TRUE);
            EnableWindow (GetDlgItem (hwnd, IDD_20PLUS), TRUE);
        }

        // Get the length of each track
        for (i=1; i<=wNumberOfTracks; i++) {
            MCIStatus.dwItem = MCI_STATUS_LENGTH;
            MCIStatus.dwTrack = (DWORD) i;
            mciSendCommand (MCIOpen.wDeviceID, MCI_STATUS,
                MCI_TRACK | MCI_STATUS_ITEM | MCI_WAIT,
                (DWORD) (LPSTR) &MCIStatus);
            awTrackLength[i-1] =
                ((WORD) MCI_MSF_MINUTE (MCIStatus.dwReturn) * 60) +
                (WORD) MCI_MSF_SECOND (MCIStatus.dwReturn);
        }
    }

    // Reset the status indicators if a CD was removed
    else if ((bMediaPresent) && (MCIStatus.dwReturn == FALSE)) {
        bMediaPresent = FALSE;
        for (i=1; i<=20; i++)
            EnableWindow (GetDlgItem (hwnd, i+100), FALSE);
        EnableWindow (GetDlgItem (hwnd, IDD_20PLUS), FALSE);
        if (wPageNumber != 0)
            for (i=1; i<=20; i++)
                SetDlgItemText (hwnd, i+100, _itoa (i, szBuffer, 10));
        SetWindowText (hwndTrack, "");
        SetWindowText (hwndLength, "");
        SetWindowText (hwndTime, "");
        SetScrollPos (hwndScrollBar, SB_CTL, 0, TRUE);
        InvalidateRect (hwndScrollBar, NULL, TRUE);
        return 0;
    }

    // Find out if a CD is playing
    if (bMediaPresent) {
        MCIStatus.dwItem = MCI_STATUS_MODE;
        mciSendCommand (
MCIOpen.wDeviceID, MCI_STATUS, MCI_STATUS_ITEM |
            MCI_WAIT, (DWORD) (LPSTR) &MCIStatus);

        // Update the status indicators if a CD is playing
        if (MCIStatus.dwReturn == MCI_MODE_PLAY) {
            MCIStatus.dwItem = MCI_STATUS_POSITION;
            mciSendCommand (MCIOpen.wDeviceID, MCI_STATUS,
                MCI_STATUS_ITEM | MCI_WAIT,
                (DWORD) (LPSTR) &MCIStatus);

          // Update track and length indicators if this is a new track
            if (wCurrentTrack !=
                    (WORD) MCI_TMSF_TRACK (MCIStatus.dwReturn)) {
                wCurrentTrack =
                    (WORD) MCI_TMSF_TRACK (MCIStatus.dwReturn);
                SetWindowText (hwndTrack,
                    _itoa ((int) wCurrentTrack, szBuffer, 10));
                SetWindowText (hwndLength,
                    IntToMinSec ((int) awTrackLength[wCurrentTrack-1],
                    szBuffer));
                SetScrollRange (hwndScrollBar, SB_CTL, 0,
                    (int) awTrackLength[wCurrentTrack-1], FALSE);
            }

            // Update the time indicator and the scroll bar
            if (!bScrolling) {
                SetWindowText (hwndTime,
                    TMSFtoMinSec (MCIStatus.dwReturn, szBuffer));
                SetScrollPos (hwndScrollBar, SB_CTL,
                    (((int) MCI_TMSF_MINUTE
                        (MCIStatus.dwReturn)) * 60) +
                    (int) MCI_TMSF_SECOND
                        (MCIStatus.dwReturn), TRUE);
            }
        }

        // Reset the status indicators if there is no CD playing
        else if (!bPaused) {
            GetWindowText (hwndTrack, szBuffer, sizeof (szBuffer));
            if (szBuffer[0] != 0x00) {
                SetWindowText (hwndTrack, "");
                SetWindowText (hwndLength, "");
                SetWindowText (hwndTime, "");
                SetScrollPos (hwndScrollBar, SB_CTL, 0, TRUE);
                InvalidateRect (hwndScrollBar, NULL, TRUE);
                wCurrentTrack = 0;
            }
        }
    }
    return 0;
```

Figure 5: **The WM_TIMER routine process messages sent to CDPLAYER once per second by using the Windows timer allocated at the beginning of the program. Every second, it checks the status of the CD-ROM drive and updates the on-screen status indicators.**

TrackNumber, M=0, S=0, and F=1. Then mciSendCommand is called to transmit an MCI_PLAY command to the driver, with an MCI_FROM flag telling it that the dwFrom field contains a starting position. You may also specify the place where play will end by filling in the dwTo field and including an MCI_TO flag. With no flag, play will continue to the end of the CD's final track.

Notice that this call to mciSendCommand includes the flag MCI_NOTIFY rather than MCI_WAIT. When the MCICDA driver completes an operation initiated by a command sent to it with the MCI_NOTIFY flag set, the driver transmits an MM_MCINOTIFY message to the calling program's window procedure. The message is also sent if the command is superseded or aborted, or if a device error occurs.

In this example, the window procedure, WndProc, will receive an MM_MCINOTIFY message when the end of the CD is reached. Figure 4 shows the code that processes the MM_MCINOTIFY message. CDPLAYER first determines if wParam equals MCI_NOTIFY_SUCCESSFUL, which would indicate that the end of the CD has been reached. It then queries the Continuous Play check box to find its state. If the box is checked, CDPLAYER starts playing again at track 1. Otherwise, the routine returns to WndProc without further action.

THE WM_TIMER MESSAGE Try this experiment. Insert an audio disk in your CD-ROM drive and press Play (or a numbered track button). Close CDPLAYER (you'll continue to hear music), wait a moment, and start it again. Notice that it picks right up as if it had been running the whole time, correctly identifying the number of tracks, the one currently playing, and the minutes and seconds into it. Next, manually eject the CD using the button on the front of the

drive (not the Eject button in the CDPLAYER window!). After a brief pause, CDPLAYER should recognize that the disk has been ejected and blank the track buttons and status indicators. As if by magic, CDPLAYER is able to sense the status of the media in the drive and adjust its actions accordingly.

To unveil the method behind the magic, look at Figure 5, which shows the WndProc routine that processes WM_TIMER messages. Whenever CDPLAYER receives this message from the timer, it executes a series of calls to determine the state of the media in the drive and update the status indicators.

The program first finds out if it's iconized and if the system menu's "Minimize Time Slice" option is selected. When both conditions hold, the routine processing WM_TIMER messages returns to the caller without further action, which reduces the overhead CDPLAYER imposes on the system to nearly zero.

If either test (or both) fails, the routine sends an MCI_STATUS_MEDIA_PRESENT command to the MCICDA driver to determine if the drive contains a CD. If it does now, but didn't at the last processing of a WM_TIMER message, CDPLAYER queries the driver for the number of tracks on the disk and then for the length of each. Using this information, it enables the appropriate track buttons. If the drive held a CD when a WM_TIMER message was last received but no longer does, CDPLAYER disables the track buttons and scroll bar, blanks the status indicators, and returns.

When CDPLAYER finds a CD in the drive, it issues an MCI_STATUS_MODE command to find out if the disk is playing. If so, the program queries the driver for the current position of the play head (track, minute, second, frame) and uses the response to update the status indicators and scroll bar. If the CD isn't playing, CDPLAYER blanks the status indicators and resets the scroll bar. Because WM_TIMER messages arrive every second, CDPLAYER quickly senses changes in media status, even when they result from external events such as a manual eject.

THE WM_CTLCOLOR MESSAGE What is WM_CTLCOLOR? It is a message that a control sends to its parent just before painting itself. The message's parameters

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Processing the WM_CTLCOLOR Message

```
case WM_CTLCOLOR:
    // Paint status indicators red
    if ((LOWORD (lParam) == hwndTrack) ||
        (LOWORD (lParam) == hwndLength) ||
        (LOWORD (lParam) == hwndTime)) {
        SetBkColor (wParam, GetSysColor (COLOR_WINDOW));
        SetTextColor (wParam, RGB (255, 0, 0));
        UnrealizeObject (hBrush);
        point.x = point.y = 0;
        ClientToScreen (hwnd, &point);
        SetBrushOrg (wParam, point.x, point.y);
        return ((DWORD) hBrush);
    }
    break;
```

Figure 6: **A child window sends a WM_CTLCOLOR message to its parent before it repaints itself. Here, the text color is changed to red so that certain text controls in the CDPLAYER window will be painted red instead of black.**

include: wParam, a handle to the control's device context; and lParam, which holds the handle of the control window in its low word and, in its high word, an integer identifying the type of control that sent the message. A Windows program can alter the colors used to paint a control by intercepting WM_CTLCOLOR messages and altering the color attributes defined in the device context. When WM_CTLCOLOR processing is complete, the window procedure must return a handle to a brush that will be used to paint the background of the control window. During processing of the WM_CREATE message, CDPLAYER obtains a handle to a background brush with the statement

```
hBrush = CreateSolidBrush (GetSysColor
  (COLOR_WINDOW));
```

When CDPLAYER receives a WM_CTLCOLOR message, it checks the handle in the low word of lParam to make sure the message came from one of the three text controls that should have its color changed. If so, CDPLAYER sets the background color to that of the brush and sets the text color to red (RGB (255, 0, 0)). It then resets the brush origin so no discontinuity appears if the window background is dithered. The WM_CTLCOLOR message handler ends with a return that passes back the background brush handle obtained earlier. The result? Windows paints the three status indicators red, making them stand out from the rest of the controls in the CDPLAYER window.

A final note here about WM_CTLCOLOR concerns the WM_ SYSCOLORCHANGE message. Recall that CDPLAYER obtains a handle to a background brush when it processes the WM_CREATE message. What happens if, after starting CDPLAYER, the user changes the system color on which the brush was based? To account for this possibility, CDPLAYER processes WM_SYSCOLORCHANGE messages, which Windows broadcasts to applications when a system color is changed. If CDPLAYER receives this message, it deletes the current brush and creates a new one based on the modified system color. This simple solution ensures that the window backgrounds—near the text controls and in the rest of the CDPLAYER window—will match, even if the user changes a Control Panel color setting.

SOURCES OF MCI INFORMATION If you're interested in learning more about Windows 3.1's Media Control Interface and how to use it, two good sources are the *Microsoft Windows Multimedia Programmer's Guide* and the *Microsoft Windows Multimedia Programmer's Reference.* The Windows SDK includes both of these books. Though tersely written, they represent the definitive reference works on the subject, and they're loaded with information about programming multimedia devices. In addition, peruse Charles Petzold's ruminations about multimedia programming in his Environments column—a year-long series that just ended in the November 10, 1992, issue. □

JEFF PROSISE IS A CONTRIBUTING EDITOR TO *PC MAGAZINE.*

LAB NOTES

Customizing Windows' Common Dialog Boxes, Part 2

BY DANNY THORPE AND PAT RITCHEY

Customization of the common dialogs that Microsoft includes with Windows 3.1 (in COMMDLG .DLL) has become a hot topic in the programming corners of bulletin boards, CompuServe forums, and software shops throughout the Windows world. Some developers want to add functionality to the dialogs; others want them to fit the special look of an application or product line. And although Microsoft advises against altering their appearance, the company still provides both standard options to hide controls and programming hooks to allow even more radical customization. Perhaps this is a nod toward human nature: We all want our programs to stand apart from the crowd.

Part One of this article covered the two means of customization provided by COMMDLG: dialog template substitution and dialog message processing employing a hook procedure. We also constructed a simple object wrapper to automate most of the tedious data initialization required by a common dialog. We tied that into the Object Windows Library (OWL) application framework so that if you're familiar with OWL, you could feel at home using, manipulating, or extending the otherwise alien common dialogs.

PHASE 3: SOME SIMPLE, SOME NOT Object wrappers are fun, but they serve the programmer more than the user. No visible difference exists between the Open dialog produced by the TFileDlg object shown in the previous article and one generated "manually" (that is, by invoking the common dialog after filling its data structure with your own code). The difference comes from the way the dialog is controlled inside the program.

In this installment, we will combine the customization and control techniques discussed last time, thus making an OWL object that produces a COMMDLG dialog with the look and feel of the Borland Windows Custom Controls (BWCC). We'll see two versions of the same demo: one written in Turbo Pascal for Windows (TPW) using its OWL, the other written in Borland C++ and its OWL.

By combining the customization and control techniques learned in Part 1, you can make an OWL object that produces a COMMDLG dialog with the look of the BWCC.

The BWCC library, BWCC.DLL, contains code to produce the "chiseled steel" dialog backgrounds as well as the bitmapped radio and check-box buttons seen in various Windows applications and Borland's TPW and Resource Workshop (RW). Normally, to put a BWCC-style dialog in a program, you need only change the dialog template's CLASS field to BorDlg and make the program load BWCC.DLL. It isn't always this easy, though. Applying the BWCC look to the COMMDLG dialogs can be as simple as a class name change, but as we'll see in COMMDLG's Font and Color dialog, it can prove to be nearly impossible. We'll illustrate the easy case (Open) initially, give an example of a tough one (Font) next, and wrap up with a discussion of the most difficult (Color).

EASY OPEN Converting the Open common dialog to the BWCC look requires little effort. Simply commandeer an Open dialog template (either from the SDK or from COMMDLG.DLL itself), change the dialog's CLASS name to BorDlg, and, if you'd like, add some of Borland's spiffy shade controls to frame the standard list boxes and controls. Remember, too, to change the text OK and Cancel buttons to the more colorful BWCC BorButton equivalents. Now name this dialog template File Open_BWCC and save it in a resource file named CUSTOM1.RC, as shown in Figure 1.

In the previous article, we created an object called TFileDlg, putting it in a unit called UTEST2.PAS. To use the new FileOpen_BWCC dialog template, we simply make the TFileDlg object fill in the lpTemplateName field of the TOpenFileName structure and also set the OFN_EnableTemplate bit in the Flags field of that structure. This will make COMMDLG read the dialog template from our executable file. Since these are just additions to what TFileDlg already does, it's easy to create a descendant object type that adds the desired behavior; call it TBWCCFileDlg. We'll create a new unit called CUSTOM1.PAS, shown in Figure 2, and add the two extra template setup steps to it. This will define our new dialog object.

Two other features enhance the CUSTOM1 unit's usefulness: its use of the BWCC unit and the presence of its own resource file containing the BWCC-customized Open dialog template. Incorporation of its own resource file makes the unit self-contained; you can simply in-

CUSTOM1.RC

Complete Listing

```
#include "\tpw\owl\wobjects.h"
MainMenu MENU
BEGIN
        POPUP "&File"
        BEGIN
                MENUITEM "&Open", 101
                MENUITEM SEPARATOR
                MENUITEM "E&xit", cm_Exit
        END
END
FileOpen_BWCC DIALOG 15, 22, 204, 141
STYLE DS_MODALFRAME | WS_POPUP | WS_CAPTION | WS_SYSMENU
CLASS "BorDlg"
CAPTION "Open"
FONT 8, "Helv"
BEGIN
LTEXT "File &Name:", 1090, 14, 9, 76, 10
CONTROL "", 1152, "EDIT", ES_LEFT | ES_AUTOHSCROLL | ES_OEMCONVERT | WS_CHILD | WS_VISIBLE | WS_BORDER | WS_TABSTOP, 14, 19, 90, 12
CONTROL "", 1120, "LISTBOX", LBS_STANDARD | LBS_OWNERDRAWFIXED | LBS_HASSTRINGS | LBS_DISABLENOSCROLL | WS_CHILD | WS_VISIBLE | WS_TABSTOP, 14, 35, 90, 68
LTEXT "&Directories:", -1, 121, 10, 92, 9
CONTROL "", 1088, "STATIC", SS_LEFT | SS_NOPREFIX | WS_CHILD | WS_VISIBLE, 121, 20, 92, 9
CONTROL "", 1121, "LISTBOX", LBS_STANDARD | LBS_OWNERDRAWFIXED | LBS_HASSTRINGS | LBS_DISABLENOSCROLL | WS_CHILD | WS_VISIBLE | WS_TABSTOP, 121, 36, 92, 68
LTEXT "List Files of &Type:", 1089, 14, 105, 90, 9
CONTROL "", 1136, "COMBOBOX", CBS_DROPDOWNLIST | CBS_AUTOHSCROLL | WS_CHILD | WS_VISIBLE | WS_BORDER | WS_VSCROLL | WS_TABSTOP, 14, 115, 90, 36
LTEXT "Dri&ves:", 1091, 121, 106, 92, 9
CONTROL "", 1137, "COMBOBOX", CBS_DROPDOWNLIST | CBS_OWNERDRAWFIXED | CBS_AUTOHSCROLL | CBS_SORT | CBS_HASSTRINGS | WS_CHILD | WS_VISIBLE|
 WS_BORDER | WS_VSCROLL | WS_TABSTOP, 121, 116, 92, 68
CONTROL "OK", 1, "BorBtn", 0 | WS_CHILD | WS_VISIBLE | WS_GROUP, 235, 11, 38, 25
CONTROL "Cancel", 2, "BorBtn", 0 | WS_CHILD | WS_VISIBLE | WS_GROUP, 235, 43, 38,
CONTROL "&Help", -1, "STATIC", SS_LEFT | WS_CHILD | NOT WS_VISIBLE | WS_GROUP | WS_TABSTOP, 292, 69, 2, 8
CONTROL "", 1030, "BorBtn", 0 | WS_CHILD | WS_VISIBLE, 235, 74, 37, 25
CONTROL "", -1, "BorShade", 1 | WS_CHILD | WS_VISIBLE, 228, 108, 53, 17
CONTROL "", -1, "BorShade", 3 | WS_CHILD | WS_VISIBLE, 224, 0, 1, 141
CONTROL "", -1, "BorShade", 1 | WS_CHILD | WS_VISIBLE, 118, 7, 99, 128
CONTROL "", -1, "BorShade", 1 | WS_CHILD | WS_VISIBLE, 11, 7, 98, 128
CONTROL "&Read Only", 1040, "BorCheck", 3 | WS_CHILD | WS_VISIBLE | WS_GROUP | WS_TABSTOP, 232, 111, 47, 12
END
```

Figure 1: **This resource script file defines the dialog template for an Open common dialog with the Borland custom look.**

CUSTOM1.PAS

Complete Listing

```
unit custom1;

interface

uses winprocs, wintypes, wobjects, bwcc, utest2;

type
 *PBWCCFileDlg = ^TBWCCFileDlg;
  TBWCCFileDlg = object(TFileDlg)
    constructor Init(AParent : PWindowsObject;
                     AFlags    : Longint;
                     AFileName : Pchar;
                     ANameLength : Integer);
  end;


implementation

{$R custom1}
uses commdlg;

constructor TBWCCFileDlg.Init(AParent : PWindowsObject;
                              AFlags    : Longint;
                              AFileName : Pchar;
                              ANameLength : Integer);
begin
  TFileDlg.Init(AParent, AFlags, AFileName, ANameLength);
  with OFN do
  begin
    Flags := Flags or OFN_EnableTemplate;
    lpTemplateName := 'FileOpen_BWCC';
  end;
end;

end.
```

Figure 2: **This unit creates a descendent of the TFileDlg object we created last time. This new object combines a custom dialog tamplate (which specifies a BorDlg dialog class and BWCC custom controls) with the control structure inherited from TFileDlg.**

clude it in your main program and use the TBWCCFileDlg object. You needn't worry about the name of the appropriate dialog template or the location of the resource file that contains it. The unit encapsulates these details.

Using the BWCC unit in a Pascal program will cause Windows to load the BWCC.DLL library when it loads your main program. The BWCC unit defines access to the miscellaneous functions that BWCC.DLL provides, but we're not really interested in those functions; we just need to make sure that BWCC.DLL is loaded with our program. When BWCC.DLL loads, it publishes the BWCC class names that our program needs, such as BorDlg and BorButton. Our program doesn't need to call BWCC functions; it just creates (or loads from resources) dialogs and controls with the class names BWCC has published.

For brevity, we show example code set up to compile in TPW 1.5. If you have TPW 1.0 and RW, you'll need to substitute the RW WOBJECTB unit for the standard WOBJECTS unit in Figure 2. TPW 1.5's WOBJECTS has built-in support for BWCC, which you activate by simply using the BWCC unit along with WOBJECTS. TPW 1.0 users who lack RW won't have BWCC.DLL or any of the interface units and won't be able to use these BWCC samples. The example code in this article contains conditional statements that check the compiler version and then select the USES clause appropriate to your TPW version.

TEST3.PAS, shown in Figure 3, contains a minimal OWL program that displays the test dialog in response to selecting File | Open from the menu. The resource script for this test program, TEST3.RC (shown in Figure 4) contains only a menu definition. TEST3.PAS,

TEST3.PAS

Complete Listing

```
program Test3;

uses winprocs, wintypes, wobjects, strings, commdlg, custom1;

{$R Test3}

type

  TMyApp = object(TApplication)
    procedure InitMainWindow; virtual;
  end;

  PMyMainWindow = ^TMyMainWindow;
  TMyMainWindow = object(TMDIWindow)
    procedure cmFileOpen(var Msg: TMessage); virtual cm_First + 101;
  end;

procedure TMyMainWindow.cmFileOpen(var Msg: TMessage);
var
  FileName: array [0..79] of Char;
  Result: Integer;
begin
  StrCopy(FileName, '*.pas');
  Result := Application^.ExecDialog(new(PBWCCFileDlg,
        Init(@Self, OFN_FileMustExist, Filename, SizeOf(Filename))));
  if Result = idOk then
    MessageBox(HWindow, Filename, 'You selected', mb_OK);
end;

procedure TMyApp.InitMainWindow;
begin
  MainWindow := new(PMyMainWindow, Init('Test CommDlg',
                      LoadMenu(HInstance, 'MainMenu'))));
end;

var MyApp: TMyApp;
begin
  MyApp.Init('TestCommDlg');
  MyApp.Run;
  MyApp.Done;
end.
```

Figure 3: **This small program is the test platform for the TBWCCFileDlg, which customizes the Open common dialog with BWCC controls.**

with a few exceptions, is identical to the program used to test the TFileDlg object last time. Its USES clause now refers to the new CUSTOM1 unit. In addition, the line that creates the dialog object and executes the dialog has also changed, from

```
Result := Application^.ExecDialog
  (new(PFileDlg, Init(. . .)));
```

to

```
Result := Application^.ExecDialog
  (new(PBWCCFileDlg, Init(. . .)));
```

Compile this program and run it. Select File | Open from the menu and—presto! You'll witness the results of converting your first common dialog to the BWCC look as shown in Figure 5. We accomplished this feat by:

- copying the Open dialog template from COMMDLG.DLL;
- changing the template's dialog class name to BorDlg and sprucing up the dialog with some BWCC controls; and
- adding a few lines to existing code to tell COMMDLG to use the new dialog template and to have BWCC.DLL load with our program.

Now that's what I call easy!

After the initial rush wanes, however, you'll realize that the dialog is imperfect. The list boxes display their text with a white background, but the unoccupied lower portions are painted gray, as you can see in the screenshot in Figure 5.

The rest of this article discusses these small irregularities, which become apparent if you make radical changes to the COMMDLG dialogs. These aberrations (or others like them) can also result from minor customization of the common dialogs. The workarounds we'll explore should function in such cases as well.

Understand that this level of customization stretches the limits of COMMDLG's (and BWCC's) flexibility. We're probably venturing well beyond what the COMMDLG designers had in mind when they decided to open it up for adaptation. It's only natural to find a few chinks in the armor of a library under siege from such a number of customizations. Fortunately, most of these chinks can be plastered over or avoided with a little bit of clever programming.

When redrawn, the FileOpen dialog's list boxes need their backgrounds completely erased. Since we're in an OWL dialog object, it's simple to attach OWL objects to list-box controls to alter their behavior. We need a special list-box object that responds to WM_ERASEBKGND messages by filling the list box with the system window background color. Figure 6 shows a revised CUSTOM1.PAS with our "object in progress" TCDListBox, which does just that.

The new list box object is used in the TBWCCFileDlg.Init constructor like this:

```
var Dummy: PWindowsObject;
begin
. . .
  Dummy := New(PCDListBox,
    InitResource(@Self, 1120));
  Dummy := New(PCDListBox,
    InitResource(@Self, 1121));
```

These lines create TCDListBox object instances on the heap to correspond to the two list-box controls in the Open common dialog. Using the Resource Workshop, we see that the IDs of those controls are 1120 and 1121. By constructing our list-box objects with the special InitResource constructor, we link the objects to the existing list-box controls in the dialog.

The objects will be allocated on the heap and insert themselves into the parent's child list, so there is no need to save the pointer value stored in Dummy. The New allocation function requires an instance variable to receive the result, thus our Dummy pointer variable. When the dialog object is disposed, it will dispose of all its child objects and release the memory they occupy.

Recompile the test program with this

TEST3.RC

Complete Listing

```
#include "\tpw\owl\wobjects.h"

MainMenu MENU
BEGIN
     POPUP "&File"
    BEGIN
        MENUITEM "&Open", 101
        MENUITEM SEPARATOR
         MENUITEM "E&xit", cm_Exit
   END

END
```

Figure 4: **The resource file for our test program contains only a menu definition. The dialog template used by the TBWCCFileDlg object is stored in a separate resource file used by the unit that defines the object.**

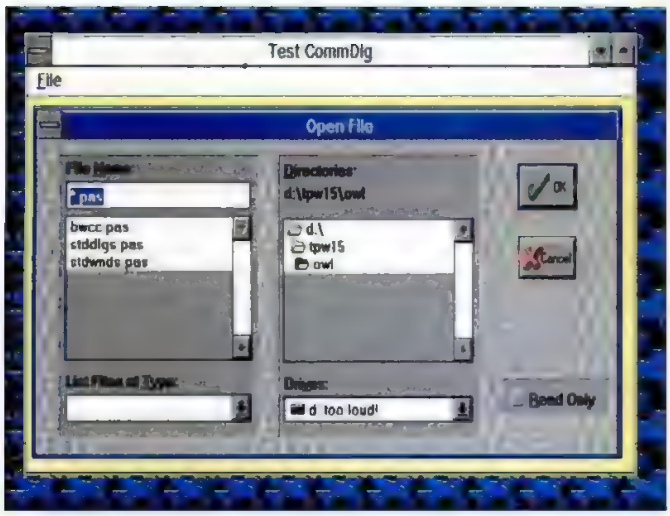

***Figure 5:* Success! A BWCC version of the Open common dialog! Well, almost: The list boxes shouldn't be half gray and half white.**

modified CUSTOM1.PAS unit, run it, and select File | Open to bring up the dialog. Now when the list boxes are drawn, the white backgrounds extend from top to bottom (as shown in Figure 7) instead of showing only under the text.

Look again at Figure 3, the test program that invokes the TBWCCFileDlg object, and notice the OFN_FILEMUSTEXIST flag we pass to the TFileDlg constructor in the TMyMainWindow.cmFileOpen method. Run the test routine once more and enter a nonexistent filename in the FileOpen dialog. Pressing Enter or clicking on the OK button brings up an error-message box with text indicating that the file must first exist. The OFN_FILEMUSTEXIST option flag won't let OK exit the dialog until you enter a valid filename.

That's fine, but the error-message box was a plain Windows one; it didn't follow the BWCC style. COMMDLG will display error messages or request confirmations using message boxes, but what if you want those boxes to match the rest of your application's tone? How can your program specify the appearance of error-message boxes? It can't. COMMDLG doesn't notify the hook function (your object) when such a message needs to be displayed. Microsoft acknowledges this as a valid concern and has accepted it as a suggestion for future COMMDLG.DLL versions.

Making custom bitmapped buttons for common dialog predefined buttons (other than OK and Cancel) presents another problem when applying the BWCC look to common dialogs. But unlike the error-message box problem, this one we can solve ourselves.

All of the common dialogs have an optional Help button, and BWCC has a set of bitmaps for a colorful one, but BWCC's uses a different control ID than COMMDLG's (998 versus 1038). Also, BWCC's numbering scheme for bitmapped buttons (which associates a series of bitmaps with a button ID) doesn't work for IDs above 1000. You can solve the problem by creating a BWCC bitmapped button with the ID needed by COMMDLG. Then you can borrow the button bitmaps from the regular BWCC button with the matching functionality. The dialog object can load the Help button bitmaps from the BWCC DLL module and assign them to the COMMDLG

CUSTOM1.PAS, revised

Complete Listing

```
unit custom1;  { REVISED }

interface

uses winprocs, wintypes, wobjects, bwcc, utest2;

type
  PBWCCFileDlg = ^TBWCCFileDlg;
  TBWCCFileDlg = object(TFileDlg)
    constructor Init(AParent : PWindowsObject;
                     AFlags    : Longint;
                     AFileName : Pchar;
                     ANameLength : Integer);
  end;

implementation

{$R custom1}
uses commdlg;

type
  PCDListBox = ^TCDListBox;
  TCDListBox = object(TListBox)
    Brush: HBrush;
    constructor InitResource(AParent: PWindowsObject; ResourceID: Word);
    destructor Done; virtual;
    procedure WMEraseBkgnd(var Msg : TMessage);
        virtual wm_first+wm_EraseBkgnd;
  end;

constructor TCDListBox.InitResource(AParent: PWindowsObject; ResourceID:
Word);
begin
  TListbox.InitResource(AParent, ResourceID);
  Brush := CreateSolidBrush( GetSysColor( COLOR_WINDOW));
end;

destructor TCDListBox.Done;
begin
  DeleteObject(Brush);
  TListbox.Done;
end;

procedure TCDListBox.WMEraseBkgnd(var Msg: TMessage);
var
  R : TRect;
begin
   GetClientRect(hWindow,R);
   FillRect(hDC(Msg.wParam),R,Brush);
   Msg.Result := 1;
end;

constructor TBWCCFileDlg.Init(AParent : PWindowsObject;
                              AFlags    : Longint;
                              AFileName : Pchar;
                              ANameLength : Integer);
var
  Dummy: PWindowsObject;
begin
  TFileDlg.Init(AParent, AFlags, AFileName, ANameLength);
  with OFN do
  begin
    Flags := Flags or OFN_EnableTemplate;
    lpTemplateName := 'FileOpen_BWCC';
  end;
  Dummy := New(PCDListBox, InitResource(@Self, 1128));
  Dummy := New(PCDListBox, InitResource(@Self, 1121));
end;

end.
```

***Figure 6:* The highlighted areas show where we have added code to fix a painting problem in the list boxes of the Open common dialog customized with BWCC controls. When a WM_ERASEBKGND message is received, the TCDListBox object forces the entire list-box rectangle to be erased with the system window background color (normally white). TBWCCFileDlg.Init constructs one of these list-box objects for each of the two list boxes in the Open common dialog.**

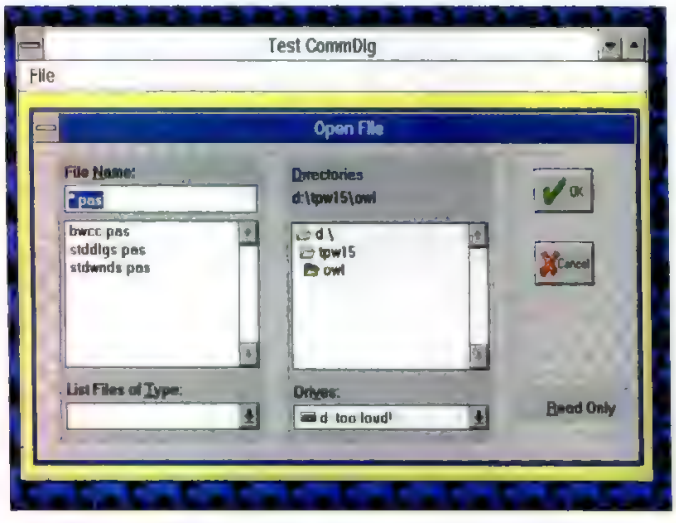

***Figure 7:* Success! A BWCC version of the Open common dialog with the corrected list boxes.**

Help button by sending a BBM_SetBits message to the button control. BBM_SetBits is a message defined by BWCC for just such a purpose: reassigning bitmaps for a bitmapped button at runtime.

The problem doesn't affect BWCC bitmapped buttons that you create, only those with predetermined IDs greater than 1000; these include some buttons in COMMDLG. Just choose IDs less than 1000 for your own bitmapped buttons and you'll need no special bitmap reassignment code.

PROBLEM CHILDREN Once you've conquered customization of the Open common dialog, it's easy to create similar objects and customizations for the SaveAs, Print, and PrintSetup dialogs. Find and Replace are a little different, since they run as nonmodal dialogs. Other than that, they customize as easily as Open.

The last two common dialogs, Font and Color, are considerably more difficult to change by our method of *subclassing* (adding another message function layer to a dialog or window—what we've been doing with objects). Both of these dialogs have special controls or special areas of the dialog that are painted in a way that makes them difficult to subclass.

Look at Figure 4, which shows the MyFontDlg dialog template created and modified in the last issue. Set the CLASS field to BorDlg, add BWCC to the TEST1 sample program's USES statement, and run that program. Bring up the modified Font dialog. Everything is in BWCC form, but what happened to the sample font display? Where it *should* appear, only an empty box shows, as seen in Figure 8.

Remember the oddities we stumbled across in the last issue? We observed that a hidden control was affecting the display of the dialog, and that the dialog function was painting on behalf of a control without using owner-drawn paint messages. That innocuous-looking little oddity just tore a hole in our BWCC ship, well below the waterline.

If this sounds like the groaning hull of a customization project sinking, it nearly was. After considerable head scratching, debugging, and rebooting, though, we produced several solutions to the Font dialog customization problem. One in particular was relatively simple, so that's the one we'll cover.

Why doesn't the BWCC dialog class name change work with the COMMDLG Font dialog? It's a matter of access and control. When you use the BorDlg dialog class name, BWCC is in control of the dialog's painting process instead of COMMDLG. Apparently, when COMMDLG is in full control of the Font dialog's painting process, it not only manages the process but also paints the sample font display on the dialog. When the BWCC is in control, COMMDLG isn't, and so the sample font display doesn't get painted.

If the sample font display were painted by a custom control, it wouldn't be swept up in this power struggle between BWCC and COMMDLG. It would simply be told to paint itself by whatever dialog function was in control. This is what happens with the many custom list boxes that you see in the other common dialogs, and that's why the other common dialogs work fine with BWCC.

The Font dialog problem can be solved by taking BWCC's dialog function out of the fray. COMMDLG's Font dialog function will be back in control, free to paint the sample font at its convenience. We can emulate the BorDlg dialog look by doing what BWCC does—paint the dialog background with a patterned brush in response to WM_EraseBkgnd messages.

We still need BWCC.DLL around to support whatever custom controls we add to the dialog (such as bitmapped buttons), but we can get by without the BorDlg dialog class in the MyFontDlg dialog template.

The font display is at least drawn at this point, but our WM_ERASEBKGND now obliterates it. The display area—rock solid when we used a BorDlg dialog class—now flickers. We can pull some tricks to prevent the overwriting causing the problem, though. The dialog's background fill only affects areas of the dialog not covered by a control. The sample font display—not covered by a visible control—gets painted over with the background brush. If we put a dialog control (say, a static text control) on top of the sample font area, the dialog will

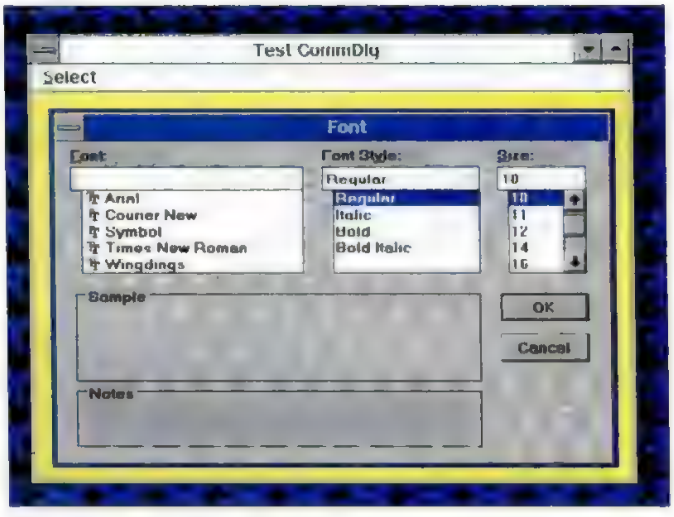

***Figure 8:* Changing the dialog class field of our customized Font dialog to BorDlg gives us the BWCC look, but what happened to the sample font display? Where it should appear, only a gray box shows.**

no longer paint over the font display.

This creates a slightly different problem, though: Now an opaque static control sits on top of the sample font display. Another trick makes the static control transparent so that the sample font display beneath will shine through. To make a control transparent, you want to receive and ignore WM_ERASEBKGND messages. If the window doesn't erase the area it occupies, then whatever was underneath the window remains visible.

Making a control transparent involves several steps. First, intercept WM_ERASEBKGND messages for the window *without* passing them on to DefWindowProc and *without* drawing anything, then tell Windows that the WM_ERASEBKGND message has been handled. This means of achieving transparency only works in certain circumstances, but it will act properly for the Font dialog.

The second step keeps the "see-through" static control from painting over what lies beneath it. The static control will get WM_PAINT messages that must be processed, but again, we don't actually want anything painted. Intercepting WM_PAINT messages and doing nothing more than calling BeginPaint and EndPaint steals the paint cycle from Windows' default processing, preventing any default painting. We then signal that the WM_PAINT message has been handled so that Windows won't try to paint something for us.

BeginPaint retrieves the invalidated rectangle for the static control that needs to be repainted and a device context to draw into. It also causes a WM_ERASEBKGND message to be sent to the control. EndPaint disposes of the device context.

Figures 9, 10, and 11 show source code for a simple TChooseFont dialog object that emulates the BWCC look and uses a see-through static control to protect

UTEST4.PAS

Complete Listing

```
program Test4;

uses winprocs, wintypes, wobjects, commdlg  UTest4, strings;

{$R Test4}

type

  TMyApp = object(TApplication)
    procedure InitMainWindow; virtual;
  end;

  PMyMainWindow = ^TMyMainWindow;
  TMyMainWindow = object(TMDIWindow)
    procedure cmChooseFont(var Msg: TMessage); virtual cm_First + 101;
  end;

procedure TMyMainWindow.cmChooseFont(var Msg: TMessage);
var
  LF: TLogFont;
  Result: Integer;
begin
  FillChar(LF, Sizeof(LF), 0);
  Result := Application^.ExecDialog(New(PChooseFontDlg,
              Init(@Self, 0, @LF)));
  if Result = idOk then
    MessageBox(HWindow, LF.lfFaceName, 'You selected', mb_OK);
end;

procedure TMyApp.InitMainWindow;
begin
  MainWindow := new(PMyMainWindow, Init('Test CommDlg',
                    LoadMenu(HInstance, 'MainMenu')));
end;

var MyApp: TMyApp;
begin
  MyApp.Init('TestCommDlg');
  MyApp.Run;
  MyApp.Done;
end.
```

Figure 9: **A small OWL program to show off the BWCC-like customized font dialog.**

UTEST4.PAS

1 of 2

```
unit utest4;

interface

{$R utest4}

uses
  wintypes, winprocs, wobjects, strings, win31, COMMDLG,BWCC;


type
   PChooseFontDlg = ^TChooseFontDlg;
   TChooseFontDlg = object(TDialog)
     CF : TChooseFont;
     GrayBrush : hBrush;
               constructor Init(AParent  : PWindowsObject;
                     AFlags   : Longint;
                     ALogFont : PLogFont);
     destructor  Done; virtual;
     function    Execute : integer; virtual;
     procedure   OK(var Msg : TMessage);
                    virtual id_First+id_OK;
     procedure   Cancel(var Msg : TMessage);
                    virtual id_first+id_Cancel;
     procedure   WMCtlColor(var Msg : TMessage);
                    virtual wm_first+wm_CtlColor;
   end;

const
  rgbLightGray  = $C0C0C0;
  idFontDisplay = 1092;

implementation

type
   PSeeThrough = ^TSeeThrough;
   TSeeThrough = object(TWindow)
     procedure SetupWindow; virtual;
     procedure wmPaint(var Msg: TMessage);
                  virtual wm_First + wm_Paint;
     procedure wmEraseBkgnd(var Msg: TMessage);
                  virtual wm_First + wm_EraseBkgnd;
   end;

{ TChooseFontDlg Methods }
constructor TChooseFontDlg.Init(AParent  : PWindowsObject;
                                AFlags   : Longint;
                                ALogFont : PLogFont);
var
  Dummy: PWindowsObject;
begin
        TDialog.Init(AParent,'CFM_BWCC');
   FillChar(CF,Sizeof(CF),0);
   GrayBrush := CreateSolidBrush(rgbLightGray);
   with CF do
   begin
     lStructSize := SizeOf(CF);
     if AParent <> nil then
        hwndOwner := AParent^.hWindow;
     lpLogFont    := ALogFont;
     Flags        := AFlags or CF_SCREENFONTS or
                     CF_ENABLEHOOK or CF_ENABLETEMPLATE;
     @CF.lpfnHook := Instance;
     hInstance    := System.hInstance;
     lpTemplateName := 'CFM_BWCC';
   end;
   Dummy := New(PSeeThrough, InitResource(@Self, idFontDisplay));
end;
```

Figure 10: **Here we have the TChooseFont object, which emulates the "Borland look" on top of the Font common dialog.**

UTEST4.PAS
2 of 2

```
destructor TChooseFontDlg.Done;
begin
  DeleteObject(GrayBrush);
  TDialog.Done;
end;


function    TChooseFontDlg.Execute : Integer;
{ Basically, this is the code from TDialog.Execute with the call to
  DialogBoxParam changed to a call to the ChooseFont function }
var
  CDError : Longint;
  OldKbHandler: PWindowsObject;
begin
  if Status = 0 then
  begin
    DisableAutoCreate;
    EnableKBHandler;
    IsModal := True;
    OldKbHandler := Application^.KBHandlerWnd;
    if ChooseFont(CF) then
      Execute := id_ok
    else
    begin
      CDError := CommDlgExtendedError;
      if CDError = 0 then
        Execute := id_Cancel
      else
      begin
        Status := -CdError;
        Execute := Status;
      end;
    end;
    Application^.KBHandlerWnd := OldKbHandler;
    HWindow := 0;
  end
  else Execute := Status;
end;

procedure   TChooseFontDlg.OK(var Msg : TMessage);
begin
  if CanClose then
     Msg.Result := 0
  else
     Msg.Result := 1;
end;

procedure   TChooseFontDlg.Cancel(var Msg : TMessage);
begin
  Msg.Result := 0
end;


Procedure TChooseFontDlg.WMCTLCOLOR;
{ Emulate the BWCC look by painting the background with BWCC's
  'chiseled steel' brush.}
begin
  SetBkColor(hdc(Msg.wParam),rgbLightGray);
  if (Msg.lParamHi = CtlColor_DLG) and (Msg.lParamLo = hWindow) then
    Msg.Result := BWCCGetPattern
  else
    Msg.Result := GrayBrush;
end;



{ TSeeThrough methods.  This object is used to 'cut a hole' in the
  BWCC facade, to allow areas that are painted by the CommDlg dialog
  function to show through. The ChooseFont dialog's sample font display
  is drawn by the CommDlg dialog function, and would be painted over
  by a normal BWCC dialog. }

procedure TSeeThrough.SetupWindow;
begin
  TWindow.SetupWindow;
  ShowWindow(HWindow, sw_Show);
end;

procedure TSeeThrough.wmPaint(var Msg: TMessage);
var PS: TPaintStruct;
begin
  Msg.Result := 1;            { Tell Windows we've handled this message }
  BeginPaint(HWindow, PS); { then fake a paint sequence. This will }
  EndPaint(HWindow, PS);     { provide the illusion of transparency.   }
end;

procedure TSeeThrough.wmEraseBkgnd(var Msg: TMessage);
var R: TRect;
begin
 Msg.Result:=1; {Prevent Windows from performing default erasures}
end;


end.
```

and show COMMDLG's sample font display. Figure 12 is a snapshot of the dialog.

THE INFLEXIBLE COLOR DIALOG The Color dialog contains a number of special controls to display color palettes and luminosity scales. The controls display themselves well when the BWCC emulation technique is used on the Color dialog. Two of the controls, however, have trouble *re*painting themselves. The vertical luminosity bar on the far right edge of the Color dialog leaves white squares behind when you move the pointer to another place on the scale. This has nothing to do with BWCC or subclassing; the white squares appear even if the system window background is nonwhite.

The other troublesome control is the color palette on the far left side of the dialog. Clicking on one of the color boxes in the palette causes a small rectangle to be drawn around it to indicate it is selected. When you click on another color box, the original rectangle is "erased" by redrawing the box frame in the system window background color setting. This control respects the system background color settings but doesn't work well with BWCC-group shade boxes or patterned dialog background brushes; in these cases, you wind up with a trail of white outline squares littering the control.

The only way we've found to correct the problem is by forcing a repaint of the control at critical moments in the dialog's message stream. This causes a lot of annoying flicker in the two controls, so the solution creates perhaps as much irritation as the original trouble.

Microsoft representatives acknowledge these display and customization problems in the Font and Color common dialogs and say they will look at them for the next version of COMMDLG.DLL. In the meantime, the Color dialog is almost uncustomizable. It's close, but the rough edges may be enough to keep you from trying to customize the Color dialog in your polished applications.

OWL OBJECT LAYER As we mentioned last time, Pat Ritchey has built an extensive OWL object layer for COMMDLG dialogs. It includes support for standard COMMDLG dialogs, BWCC versions, and programmer-supplied dialog templates. Full source code and an extensive demo program to accompany this article

TEST4.RC
Complete Listing

```
#include "wobjects.h"

MainMenu MENU
BEGIN
        POPUP "&File"
        BEGIN
                MENUITEM "&Choose Font", 101
                MENUITEM SEPARATOR
                MENUITEM "E&xit", cm_Exit
        END

END
```

Figure 11: **The menu resource for the TEST4 program.**

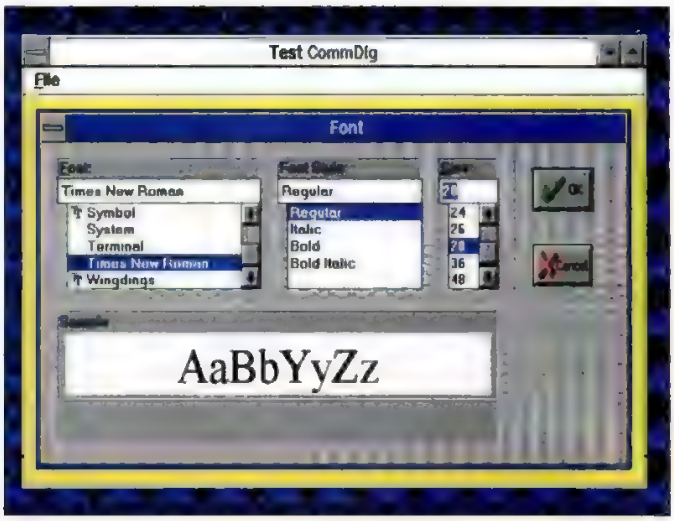

Figure 12: At last, the Font common dialog with the "Borland look," although we didn't use BWCC to get it.

are both available in the Utilities/Tips Forum on PC MagNet, archived as LN1120.ZIP. The code can be compiled with TPW 1.0 (non-BWCC), TPW 1.0 with WObjectB, or TPW 1.5 with integrated BWCC support. The examples used in this article were extracted and reduced from full-featured objects. You'll find the COMMDLG.PAS interface unit used by these examples in TPW 1.5 or with the files that accompany this article. If you don't have access to PC MagNet, you can get the complete source code and executables by sending a postcard with your name, address, and preferred disk size to Katherine West, Lab Notes, *PC Magazine,* One Park Ave., New York, NY 10016. Or fax your request to 212-503-5799. No phone calls, please.

The Windows Common Dialogs library contains valuable standardized interfaces and code for a number of dialogs that typical applications need, yet it also allows customization. In using the library and augmenting its functionality, you must strike a balance between following the herd and making a software statement.

We've shown you how to build an object wrapper around the common dialogs to automate the many data details they require. The objects simplify the process of controlling and extending the common dialog in your programs and tie directly to the Object Windows application framework. We've illustrated how numerous visual aspects of the common dialogs can be altered without changing the way the dialogs work. You can retain the user-interface consistency so dear to COMMDLG but still add the flair and sparkle that will set your programs apart from the pack. □

DANNY THORPE IS A QUALITY ASSURANCE ENGINEER AT BORLAND INTERNATIONAL. PAT RITCHEY IS PRESIDENT OF O'NEIL TENTS INC. AND AN ACTIVE MEMBER OF TEAM BORLAND IN BORLAND'S PROGRAMMING FORUMS ON COMPUSERVE.

ENVIRONMENTS

Using Text and Fonts Under The OS/2 2.0 Presentation Manager

BY CHARLES PETZOLD

Why is it that working with text and fonts is always the trickiest part of graphics programming? Most of computer graphics is basic analytic geometry—drawing lines, rectangles, ellipses, and other curves on a two-dimensional space. And even the non-vector parts of graphics programming (bitmaps and color) don't veer too far from solid mathematical foundations. Fonts are different. To a typographer, fonts are art, and they have a long history of sophisticated design. Computer graphics systems that implement fonts with any degree of integrity have to deal with classical typographical concepts, and this means that programmers have no choice but to learn about them.

Text is meant to be read, and fonts must be readable. That's the fundamental principle. There are subtleties in font design, font rendering, and page layout that affect readability even if such nuances are not at all noticeable to the average person. Moreover, text is not purely content; the style in which the text is printed on the page can affect the interpretation of the content, either positively or adversely. You don't want a wedding invitation to look like an office memorandum, or a doctoral thesis to look like advertising copy.

Before even approaching these issues, however, a graphics programmer must deal with function calls, data structures, font metrics, pixels, point sizes, baseline increments, leading, kerning, justification, and other concepts. Working with text isn't at all like drawing lines, rectangles, and bitmaps.

This is the first in a series of columns on using text and fonts under the OS/2 2.0 Presentation Manager. OS/2 has evolved into an excellent platform for sophisticated text-based applications. In particular, the support of Adobe Type 1 fonts under OS/2 makes possible the on-screen WYSIWYG display of text destined for the printer, as well as many PostScript-like special effects. We're not in Kansas anymore.

Here are some of the typographic and progamming considerations you'll need to understand in order to work with text and fonts.

NIX FIXED PITCH Working with text in computer programs is simplified somewhat when the text uses fixed-pitch fonts (fonts in which all the characters have the same width). But fixed-pitch fonts are a typographical absurdity. Before the invention of the typewriter, it never occurred to anyone that a lowercase i should occupy the same amount of space as an uppercase W. Many early computer printers had the same technological limitations as the typewriter, and character-mode video adapter boards were also limited to fixed-pitch fonts.

It's pretty well established now that fixed-pitch fonts are more difficult to read than those with variable widths, possibly because people don't actually read individual letters; instead they read combinations of letters and even whole words at a glance. It helps a lot if these letters are in close proximity and form familiar patterns.

Fixed-pitch fonts are also much more wasteful of paper real estate. For a particular font height, more variable-width characters can fit into a single line of text than fixed-width characters. Because a whole page of fixed-pitch text is simply a grid of characters, the individual lines don't guide the reader's eye across the page. This is one reason why typewritten text is often double-spaced, which wastes even more paper.

With the widespread use of graphics video adapters and printers, fixed-pitch fonts are no longer necessary or desirable, except for material that is not read in a conventional sense, such as hexadecimal dumps and program listings. It's more work on the programmer's part to use variable-width fonts, but it's worthwhile because it aids readability—and saves trees as well.

DOING FONTS RIGHT When graphics-based fonts first started appearing in printers, graphics applications, and graphical user interfaces such as the Macintosh and Windows, the fonts were almost always stored in a bitmap format. Bitmap fonts (also called image fonts or raster fonts) can be designed for maximum readability and can be rendered very quickly. But bitmap fonts have a very limiting disadvantage: They must be designed for a specific device resolution and font size. A particular bitmap font can be enlarged (generally in integral multiples) by duplicating rows and columns of pixels, but this creates noticeable jaggies. Conceivably, bitmap fonts could be decreased in size by deleting rows and columns of pixels, but with the danger of losing important information. For example,

Bitmap Font Support in OS/2

Video Resolution	Video Adapter	Font Resolution (dpi) Horizontal	Vertical
640 x 200	CGA	96	48
640 x 350	EGA	96	72
640 x 480	VGA	96	96
1024 x 768	8514, XGA	120	120

Figure 1: **The four video display resolutions supported by OS/2 bitmap fonts.**

the horizontal arm of a capital A might disappear!

More recently, outline font technology has come to the personal computer. In outline fonts (also called vector fonts), each character is defined by an outline of straight lines and curves. The coordinate points that define the outline can be scaled to a specific size. The outline is then filled. The various curves that make up the outline are generally quadratic or cubic splines. In particular, the Bezier spline has proven to be very useful for font design.

There are a couple of problems with outline fonts, however. First, it's much faster simply to draw a bitmap rather than to calculate algorithmically a filled area based on an outline. For this reason, outline fonts are implemented in printers and are often converted to bitmaps at the time they are first needed and then cached in memory. This conversion is known as *rasterization.* Although the rasterization takes some time, once it's finished, the display of the fonts can be as fast as the display of bitmaps fonts.

A more serious problem involves rounding errors when the coordinate points are scaled. For example, in many fonts the two legs of a capital H should be the same width. During the scaling and rasterization process, one leg could become a pixel wider than the other. This is particularly noticeable on low-resolution devices such as video displays, and it severely affects readability. While not nearly as noticeable on 300 dot-per-inch laser printers, it can still affect the appearance of the text.

The solution is not to blindly scale the outline coordinates, but to apply "hinting" algorithms that retain the correct proportions of the fonts. Thus, a hinted outline font is more like a program than a collection of dumb data. Adobe was the first company to bring hinted outline fonts to mainstream personal computers in a big way, albeit in PostScript printers rather than on video displays. Until a few years ago, programs still had to approximate printer fonts on video displays by using bitmap fonts. To resolve this problem, the Adobe Type Manager (ATM) program was released first for the Macintosh and later for Windows and was integrated into the OS/2 Presentation Manager, allowing Adobe outline fonts to be used on video displays and non-PostScript printers under these environments. The Adobe Type 1 font format is now publicly documented. Hundreds of Type 1 fonts are available from Adobe and other font manufacturers.

Another major outline font standard has emerged recently, bolstered by its inclusion in Windows 3.1. This is TrueType, developed by Apple and Microsoft. Working with TrueType fonts under Windows 3.1 will be extensively covered in my forthcoming book, entitled *Programming Graphics in Windows,* to be published by Microsoft Press.

Although the conversion of fonts known as rasterization takes some time, once it's finished the display of the fonts can be as fast as the display of bitmap fonts.

FAMILIES, FACES, AND POINTS Traditionally, fonts have been identified simply by a typeface name and a size. Each typeface belongs to a family. Type families have simple names such as Bookman, Helvetica, Garamond, and Times. Within each family, there are usually several variations:

- The strokes of the characters can be light or heavy in various degrees, yielding typeface names such as Helvetica Ultra Light, Helvetica Thin, Helvetica Light, Helvetica Medium, Helvetica Bold, Helvetica Heavy, and Helvetica Black.
- The widths of the characters can be narrower or wider than usual for typefaces such as Helvetica Condensed, Helvetica Narrow, Helvetica Compressed, or Helvetica Extended.
- The characters can be slanted to the right, giving us typefaces like Helvetica Italic or Helvetica Oblique. (Generally, the term *oblique* refers to characters that are simply slanted, while *italic* implies that the characters are also stylistically different from the *roman* or upright font.)

These three variations can be combined in a single typeface name—for example, Helvetica Bold Extended Oblique. Typeface names may also include the copyright holder of the font and perhaps a code number.

In recent times, three families have become a minimum standard (of sorts) for font support. These are Courier, Times, and Helvetica in normal, bold, italic, and bold italic versions. Add a "symbol" font and you have the PostScript 13 font collection.

Courier is a fixed-pitch font that looks like typewriting. It's mostly used for program listings and manuscripts. (I usually print this column in Courier, like this, before giving it to my editor.)

Times is a very popular font for newspapers and magazines; it was originally designed for the *Times of London* in the 1930s. (The text you're reading now is Times.) Helvetica is a sans serif typeface, without the little turns at the ends of the letter strokes. (This

Bitmap Fonts in OS/2 2.0

Face and Family Name	Point Sizes	File
System Proportional	10	DISPLAY.DLL
System Monospaced	10	SYSMONO.FON
Courier	8, 10, 12	COURIER.FON
Helv	8, 10, 12, 14, 18, 24	HELV.FON
Tms Rmn	8, 10, 12, 14, 18, 24	TIMES.FON

Figure 2: **This shows all the bitmap fonts available in OS/2, Version 2.0, along with the filename for each font.**

sentence is in Helvetica.) Because serifs are believed to aid read-ability by guiding the eye horizontally across the letters, sans serif fonts are usually restricted to relatively short blocks of text.

Since typeface names are usually copy righted and must be licensed from the copyright holder, font clones with different names are very common. For example, in Windows prior to Version 3.1 and in the OS/2 Presentation Manager, bitmap fonts were named Helv and Tms Rmn (pronounced "tims rimmin" by the graphics folks at Microsoft). The TrueType fonts in Windows 3.1 include a Helvetica clone called Arial and a Times clone called Times New Roman.

Along with a typeface name, a font is identified by a size in points. In computer typography, a *point* is a measure equal to 1/72nd of an inch. (In traditional typo graphy, a point is actually somewhat smaller.) The point size is the maximum height of the characters, measured from the bottom of the longest descender to the top of the highest ascender of the upper- and lowercase alphabet, excluding any diacritical marks.

THE OS/2 BITMAP FONTS The OS/2 2.0 Presentation Manager supports two different types of fonts—bitmap fonts, essentially the same since OS/2 1.1; and Adobe Type 1 fonts, first supported under OS/2 1.3. A PM version of the Adobe Type Manager is implemented in a dynamic link library called PMATM.DLL.

As noted, bitmap fonts must be designed for specific display resolutions and point sizes. OS/2 2.0 is shipped with bitmap fonts for four different video display resolutions, which are shown in Figure 1. (I don't know if anyone is actually running OS/2 2.0 with a CGA or EGA, but there they are.)

These font resolution values are not quite real. Most CGA, EGA, and VGA adapters are about 10 inches wide, which would mean a horizontal resolution of 64 dots per inch (640 pixels divided by 10 inches) rather than 96. Fonts based on these font resolutions would appear on the screen larger than a ruler would imply.

This is done for a couple of reasons: People generally view video displays from a longer distance than they read paper. Some small fonts may be readable on paper, but not on the display if they're not enlarged. By implying that the width of a CGA, EGA, or VGA adapter is actually 6.7 inches (640 pixels divided by 96 dots per inch), a word processing program can allow a 6.5-inch text width, which is appropriate for 8.5-inch wide paper with 1-inch margins.

In addition, the font resolutions are chosen so that conversion from points to pixels is fairly simple. There are 72 pixels per point, so a 48-dpi font resolution yields 2 pixels per 3 points. For 72 dpi, each pixel is a point. For 96 dpi, there are 4 pixels per 3 points, and for 120 dpi, there are 5 pixels per 3 points.

The bitmap fonts available in OS/2 2.0 are listed in Figure 2. They are essentially the same as the bitmap fonts in Windows. Figure 3 shows these fonts under the OS/2 Presentation Manager running on a VGA.

Outline Fonts in OS/2 2.0

Family Name	Face Name	File
Courier	Courier	COURIER.PSF
	Courier Italic	
	Courier Bold	
	Courier Bold Italic	
Helvetica	Helvetica	HELVETIC.PSF
	Helvetica Italic	
	Helvetica Bold	
	Helvetica Bold Italic	
Times New Roman	Times New Roman	TIMESNRM.PSF
	Times New Roman Italic	
	Times New Roman Bold	
	Times New Roman Bold Italic	
Symbol Set	Symbol Set	COURIER.PSF

***Figure 4:* The Adobe Type 1 outline fonts included with OS/2 2.0.**

The System Proportional font (used by default in the OS/2 Presentation Manager) is stored in the device driver for the video display. The SYSMONO.FON file has four fixed-pitch system fonts, one for each of the four video resolutions. (If you run EXEHDR on SYSMONO.FON, you'll find it has five resource blocks. The first resource block in a .FON file is a font directory.)

The other three font files generally contain only those fonts for the resolution of your video display. If you have done an OS/2 "selective install" to change your video display driver, however, the files will contain fonts for both resolutions.

(OS/2 2.0 is also shipped with another font file called MISC.FON, which is identified in the file as containing "OS/2 Odd-sized Helvetica Fonts," but it doesn't seem to be used by OS/2 2.0.)

For all these different bitmap fonts, the family names and typeface names are the same. Bold, italic, and bold italic versions are "synthesized," which means that the OS/2 Graphics Programming Interface (GPI) alters the pixels of the font in order to create the variations. To create bold, pixels are doubled in the horizontal direction, and to create italic, pixels are shifted to the right in various degrees. Bitmap fonts can also be underlined and struck out.

Other bitmap fonts are used in windowed character-mode sessions under the OS/2 Presentation Manager, but these fonts can only be accessed using the Advanced VIO (video input/output) functions, not under GPI.

***Figure 3:* The OS/2 bitmap fonts as they appear on the screen.**

THE OS/2 OUTLINE FONTS OS/2 2.0 is also shipped with a standard set of 13 Adobe Type 1 fonts, as shown in Figure 4. The .PSF (PostScript font) files are not standard Adobe file formats. Instead, they are resource-only files in the OS/2 linear executable format. The files combine both the Adobe font metrics and the hinted outline code.

Figure 5 shows 24-point versions of these 13 fonts. As you will notice, the italic versions are separate fonts and are not synthesized; this is most obvious when you compare the Times New Roman Italic lowercase a and f with the non-italic font. For this particular screenshot, I used the actual resolution of the video display for setting the font size, which is why the 24-point fonts appear smaller than those that are shown in Figure 3.

If you're an OS/2 old-timer, you may remember that a collection of unhinted outline fonts was included in OS/2 1.1. They had the family and face names shown in Figure 6. These unhinted outline fonts are not included in OS/2 2.0, but programs using these names to select outline fonts under OS/2 2.0 will obtain the corresponding Adobe Type 1 fonts. Programs that query all the fonts available in the system—as we'll see in the next issue—will find that the Presentation Manager reports the existence of a Tms Rmn outline font as well as a Times New Roman.

ADDITIONAL TYPE 1 FONTS If you're going to be doing font programming under the OS/2 Presentation Manager, you may want to install a few more Type 1 fonts to make sure your font code works correctly. Doing this requires only the font disk from one of Adobe's Type Set packages.

From the OS/2 System folder, select System Setup and then Font Palette. Trigger the Edit button to display the Edit Font dialog. Select Add, and you'll get a dialog box listing all the .AFM (Adobe font metrics) files on the floppy disk. You can select multiple fonts to install by holding down the Shift key while selecting the names with the keyboard or mouse. By default, the files will be copied to the directory \OS2\DLL. (If you want a different directory, make sure that you've created it first.) Each installed font has two files—an .AFM file and a .PFB file that contains the actual outline font hinting data.

If you're going to be programming fonts under the Presentation Manager, you may want to install a few more Type 1 fonts to make sure your font code works correctly.

OS/2 needs both the .AFM and .PFB files without a change of disk to install a font. Therefore, if you have multiple-font floppy disks with .AFM files on one and .PFB files on another, you'll need to copy the contents to a temporary directory on your hard disk before installing them. And you need to restart OS/2 before you can use the newly installed fonts.

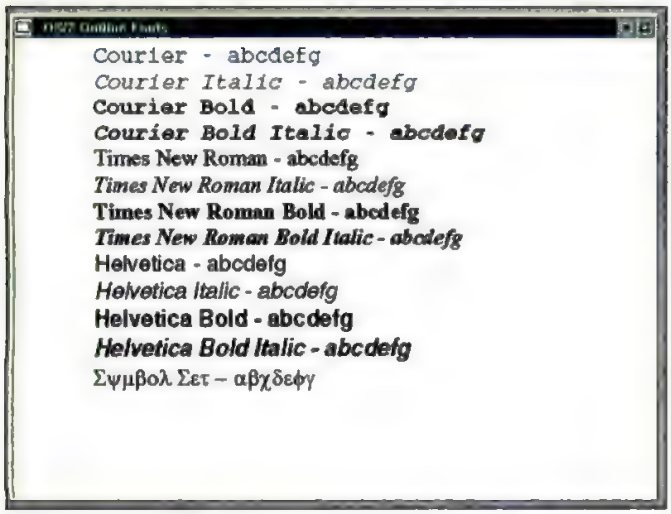

Figure 5: The OS/2 outline fonts as they appear on the display.

THINGS TO COME There are many aspects to working with text and fonts under the OS/2 Presentation Manager, and in the columns ahead I'll be touching on them all. First we'll tackle querying available fonts on the video display and printer.

Outline Fonts in OS/2 1.1

Family Name	Face name
Courier	Courier
	Courier Italic
	Courier Bold
	Courier Bold Italic
Swiss	Helv
	Helv Italic
	Helv Bold
	Helv Bold Italic
Roman	Tms Rmn
	Tms Rmn Italic
	Tms Rmn Bold
	Tms Rmn Bold Italic

Figure 6: The unhinted outline fonts included in OS/2, Version 1.1.

This involves the GpiQueryFonts function, which returns information about all the fonts in an array of FONTMETRICS structures. These fonts could be presented to the user in a dialog box for selection. In OS/2 2.0, there's a built-in standard dialog box for font selection, invoked by the WinFontDlg function using a structure of type FONTDLG.

To select a font for displaying text, you use the GpiCreateLogFont function with the FATTRS (font attributes) structure to create a logical font and GpiSetCharSet to set the font in the presentation space. You can then change certain attributes of the font using eight functions that begin with GpiSetChar. For outline fonts you must call GpiSetCharBox to set the size of the font, and you can also call GpiSetCharAngle to rotate the characters and GpiSetCharShear to give them a forward or backward tilt.

To determine information about the font currently selected in the presentation space, call the GpiQueryFontMetrics function using a FONTMETRICS structure. This structure gives you much of the information you need to display the text properly.

Because outline fonts are defined by straight lines and Bezier curves, they can often be manipulated and used like other lines in GPI. Fonts can be rotated and sheared, and the outlines of text characters can form part of a GPI path. You can use these techniques for several types of special effects. It's probably not something that you'll want to do every day, but it's a lot of fun and in an upcoming column, I'll demonstrate how to do it. □

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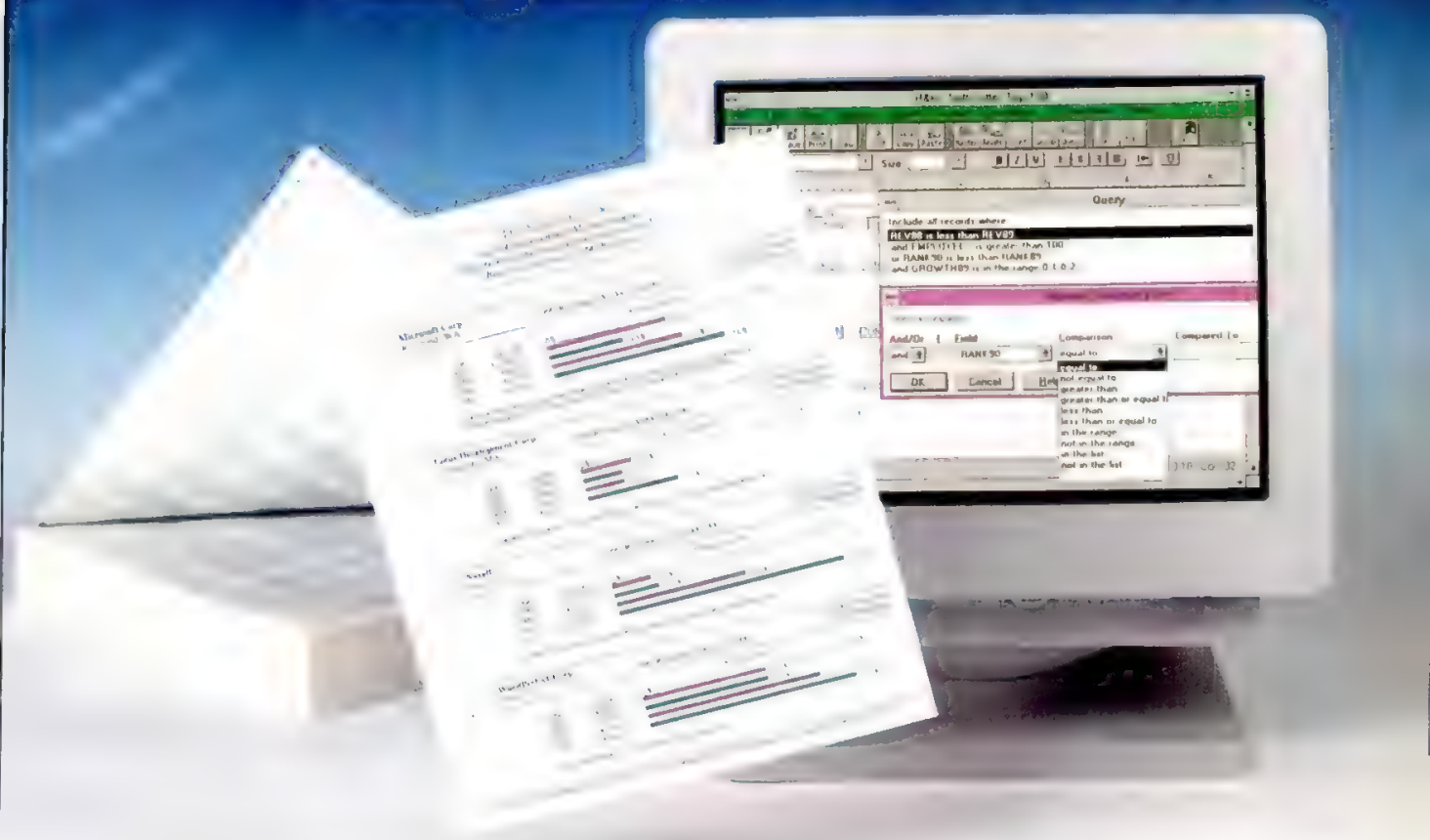

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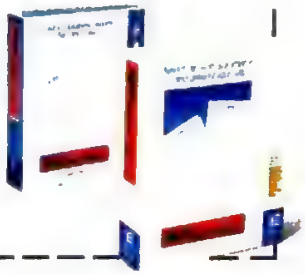

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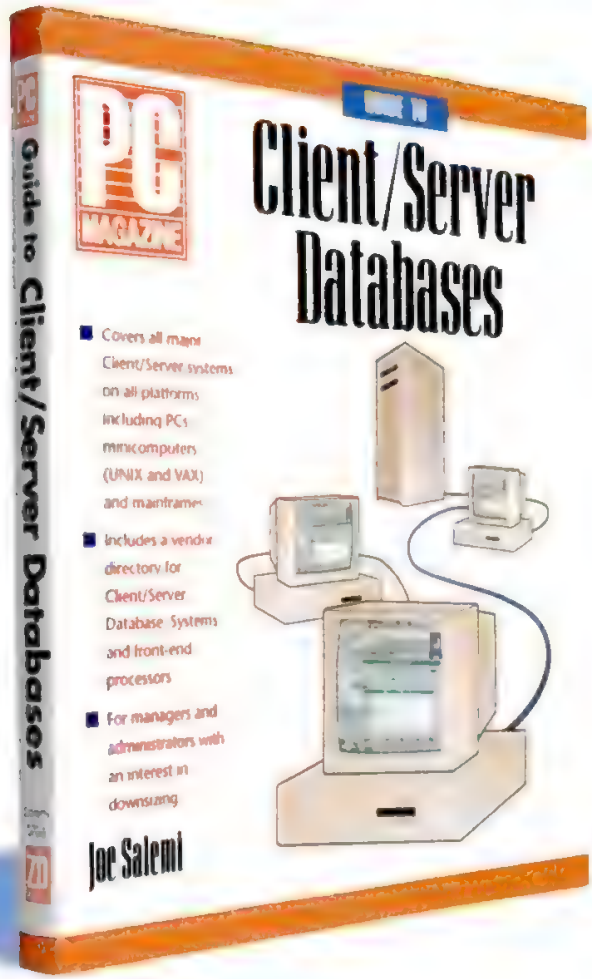
CIRCLE 315 ON READER SERVICE CARD

Words to Downsize By.



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Price: $39.95

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CIRCLE 354 ON READER SERVICE CARD

POWER PROGRAMMING

Exploring the Win32 Console API

BY RAY DUNCAN

In the last two columns we discussed the similarities between the Win16 and Win32 APIs, and surveyed the fundamental issues of porting a graphical application from the 16-bit API and segmented memory mode of Windows 3.1 to the 32-bit API and flat memory model of NT/Win32. Now it's time to take a look at some of the features of Win32 that have no counterparts in Win16—and this opens up a lot of territory! There are scores of powerful and complex new functions related to security, multitasking, the registration database, object management, interprocess communication, remote procedure calls, networking, event logging, debugging, advanced graphics functions, and so on. We'll begin with a category of functions that are both highly useful and easy to understand: the Win32 console functions.

SOME HISTORICAL PERSPECTIVE To fully understand the Win32 console API and the set of capabilities it supports, you need to hearken all the way back to the original IBM PC. When first released, that machine had a simple, character-oriented video driver in ROM (accessed via ROM BIOS Int 10h) that offered applications a low-performance but device-independent, cursor-addressable display interface. DOS's display functions were mapped onto the ROM BIOS API by the DOS console device driver, but these display functions were so slow and so primitive that few programs used them. Consequently, the ROM BIOS video API became widely used compared with the other ROM BIOS device interfaces. Even those programs that accessed the video hardware directly for maximum speed often used the ROM BIOS for relatively exotic and infrequent operations, such as programming the palette or mode switching.

When Microsoft started work in 1985 on the system we know today as OS/2, its goals were relatively limited. The operating system was initially conceived of as a multitasking, protected-mode replacement for DOS (it was even referred to internally as 286DOS for a long time), so its API was highly symmetric to the API of DOS and the ROM BIOS. In particular, 286DOS (and later OS/2) included a subsystem called VIO, whose protected-mode function calls were an almost perfect superset of the ROM BIOS Int 10h video driver's function calls. The VIO subsystem's performance was quite good, but the subsystem also permitted a protected-mode application to get the physical address of the video refresh buffer and control the display directly, just like an "ill-behaved" DOS program.

A simple command processor lets us examine the functions known as the console API, and provides an elementary but practical example of Win32 character I/O.

As time passed, 286DOS became a joint project of IBM and Microsoft, and the ambitions of the developers grew accordingly. The system was renamed OS/2, fattened up with a complex graphics engine and a graphical shell known as the Presentation Manager (PM), and started down the long dismal road we all remember so well. But through all of OS/2 1.*x*'s evolution, in spite of its graphical user interface, the VIO API was preserved and the philosophical lineage from the IBM PC ROM BIOS remained unbroken. Programmers could continue to take any character-oriented DOS program and convert it in a very straightforward manner for execution in protected mode under OS/2, without taking a year off to learn about windows, menus, device contexts, dialog boxes, messages, event-driven programming, and all the other paraphernalia associated with GUI application development.

When the Microsoft and IBM system architects went to work defining the 32-bit OS/2 2.0 API in 1988, they looked at the existing third-party products and didn't like what they saw: Instead of writing flashy new graphical applications that exploited the power of the OS/2 graphics engine, many programmers were taking advantage of the VIO interface and writing character-based DOS knock offs. But those system architects didn't react to this in a way that you and I might consider appropriate—for example, by trying to figure out why people weren't cranking out OS/2 PM applications with the same dexterity as they produced Windows products, and then changing the graphical API accordingly. Instead they resorted to coercion: They simply didn't build any 32-bit VIO functions into OS/2 2.0 at all.

This take-no-prisoners solution to the VIO "problem" certainly had an effect, but it was not the desired one. The vendors of OS/2 programming tools and utilities with traditional interfaces ran right up against a brick wall. In essence, they

were left with three options, none very appealing: They could invest a year or two learning GUI programming concepts and then totally restructure their products; they could try to build and debug hybrid products that had 32-bit segments for massive data structures or speed and 16-bit segments to communicate with the 16-bit VIO API; or they could simply continue to sell their 16-bit products into the 32-bit OS/2 2.0 user base and forgo the benefits of the 32-bit API altogether. Not too surprisingly, many chose the last course.

The team that began designing the "Portable OS/2" operating system (also known as OS/2 3.0) in late 1988 didn't make the same arrogant assumptions as the OS/2 2.0 architects. I suspect that their leader, Dave Cutler, who has a long history as a principal architect of Digital Equipment Corp. operating systems and compilers, simply dismissed with scorn the idea that a 32-bit operating system shouldn't support character I/O functions for the benefit of shells, programming tools, and system utilities. When the Great Divorce between IBM and Microsoft became public in the fall of 1990, OS/2 3.0 was suddenly rechristened as Windows/NT, and the Win32 API materialized. Win32 turned out to include—among other things—more than 30 character-oriented function calls known collectively as the console API.

THE WIN32 CONSOLE FUNCTIONS The console function calls offered by the Win32 API are clearly related to the OS/2 1.*x* VIO function calls and through them to the original ROM BIOS function calls, but the new functions differ from their predecessors in several important ways:

• The Win32 console functions are completely virtualized. Unlike OS/2's VIO subsystem, Win32 never allows an application to access the video hardware directly without the aid of a device driver.

• The Win32 console functions do not interpret ANSI escape sequences or provide any hooks for applications; the VIO functions optionally interpret ANSI escape sequences and also provide ways for applications to hook the VIO entry points on a function-by-function basis.

• The Win32 console functions integrate display output, keyboard input, and display input; for example, an application can obtain information about keyboard events and mouse events with a single function call. In OS/2, keyboard and mouse input are the job of separate subsystems.

• The Win32 console functions assume a windowing environment and make appropriate facilities available to the application (for example, to change the window title, or to query or modify the size of the window). The OS/2 VIO functions, in contrast, do not allow any control over the PM's windowing of a character-mode application by the application itself.

• The Win32 console functions include capabilities that are clearly intended to support "stream" I/O, high-level languages, and the development of programmable shells and tools such as a function call to stuff characters into the keyboard buffer. These functions have no counterparts in VIO.

A summary of the Win32 console functions is shown in Figure 1. The list may appear elaborate, but only a few of the functions are actually needed by ordinary applications. In fact, character-mode programs can be written at several

Win32 Console Functions

AllocConsole	Creates a console for the current process
CreateConsoleScreenBuffer	Returns a handle to a new screen buffer
FillConsoleOutputAttribute	Writes attributes to the screen buffer
FillConsoleOutputCharacter	Writes characters to the screen buffer
FlushConsoleInputBuffer	Clears the console input buffer
FreeConsole	Frees the current console
GetConsoleCP	Gets code page for console input
GetConsoleCursorInfo	Returns cursor size and visibility
GetConsoleMode	Returns console input or output mode
GetConsoleOutputCP	Gets code page for console output
GetConsoleScreenBufferInfo	Returns screen-buffer information
GetConsoleTitle	Returns console-window title
GetLargestConsoleWindowSize	Returns largest possible window size
GetNumberOfConsoleInputEvents	Retrieves number of console-queue events
GetNumberOfConsoleMouseButtons	Retrieves number of mouse buttons
PeekConsoleInput	Previews console input data
ReadConsole	Reads console input data
ReadConsoleInput	Reads console input data
ReadConsoleOutput	Reads screen-buffer data
ReadConsoleOutputAttribute	Reads a console attribute string
ReadConsoleOutputCharacter	Reads a screen-buffer string
ScrollConsoleScreenBuffer	Scrolls data in the screen buffer
SetConsoleActiveScreenBuffer	Changes displayed screen buffer
SetConsoleCP	Sets code page for console input
SetConsoleCtrlHandler	Sets console Ctrl-c handler
SetConsoleCursorInfo	Sets console cursor size and visibility
SetConsoleCursorPosition	Sets console cursor position
SetConsoleMode	Sets console input or output mode
SetConsoleOutputCP	Sets code page for console output
SetConsoleScreenBufferSize	Changes screen-buffer size
SetConsoleTextAttribute	Sets attributes for screen text
SetConsoleTitle	Sets console-window title string
SetConsoleWindowInfo	Sets console window size
WriteConsole	Writes to console screen buffer
WriteConsoleInput	Writes to console input buffer
WriteConsoleOutput	Writes directly to screen buffer
WriteConsoleOutputAttribute	Writes an attribute string to console
WriteConsoleOutputCharacter	Writes a character string to console

Figure 1: **These are the Win32 console functions for character-oriented input and output. Despite the elaborate list, only a few are needed for most ordinary applications.**

levels of complexity, depending on the inclinations of the software developer and the demands of the application.

The simplest way to write a character-mode application under NT is to do nothing special at all. In other words, write your application exactly as you'd write a C program under DOS or Unix, using standard C runtime library functions like gets(), puts(), and printf(). When your application runs, it will inherit a default "console," the runtime library will automatically set up standard handles for the console, and the program's input and output will be performed in the window owned by that console. The main drawbacks of this approach are that the program has no control over cursor position, text appearance, or window characteristics, and that the program is vulnerable to redirection of its input or output.

The next level of sophistication is for the application to retrieve standard input and standard output handles for its default console directly, using the Win32 function GetStdHandle(), then to use these handles with the generic I/O functions ReadFile() and WriteFile(). (Note that the handles for standard input, output, and error are not 0, 1, and 2 respectively as they are under DOS or OS/2.) This method has a pleasing level of symmetry with the program's file operations, but isolates the application from knowledge about mouse events, window resize events, and cursor location.

Alternatively, the application can use the standard handles with any of the console API functions for full control of the window, cursor, and mouse, but the drawback of this approach is that the standard handles are inherited. To avoid untoward effects on a parent character-mode application, the program must save the various attributes of the standard handles and the window during its initialization and must restore everything at exit time.

An even more flexible way for a character-mode application to perform console I/O is to open private handles to the console for input and output, using the Win32 CreateFile() function and the magic device names CONIN$ and CONOUT$. In this way, the application can be sure that the default input and output handles of its parent and any of its children will not be affected in an untoward manner. But this technique still leaves the application running in the window owned by its parent, if its parent was a character-mode application as well. The program can break loose from its default console and window and create a new console and window with the functions FreeConsole() and AllocConsole().

At any rate, once a program has console handles to work with, there is quite a range of input and output capabilities available to it. The application can control the "mode" of keyboard input: line or character, cooked or raw, and whether characters are echoed. It can choose to accept keyboard events only; keyboard and mouse events; or keyboard, mouse, and window resize events. It can query or change the cursor location, size, and visibility. And, of course, functions are provided to write characters or strings to any location in the window, to retrieve the characters that are currently displayed anywhere in the window, to scroll part or all of the window, and to flood rectangular regions of the window with a specific character and/or attribute.

NTSHELL.C

1 of 2

```
// NTSHELL.C     Simple extendable command interpreter
//               illustrating use of the WIN32 console API.
//
// Copyright 1992 Ray Duncan
// PC Magazine * Ziff Davis Publishing

#include "windows.h"
#include "stdio.h"
#include "process.h"
#include "stdlib.h"
#include "string.h"
#include "ntshell.h"

//
// This table associates "intrinsic" commands with the
// routines that carry them out.
//
struct decodeCmd commands[] = {
    "CLS",   doCls,
    "DOS",   doDos,
    "EXIT",  doExit, };

char comspec[MAXEXENAMESIZE];                // pathname of CMD.EXE

char msg1[] = "\nCan't run CMD.EXE.\n";      // misc. error messages
char msg2[] = "\nCMD.EXE couldn't execute command.\n";
char msg3[] = "\nNo COMSPEC in environment.\n";

HANDLE hConIn;                               // console input handle
HANDLE hConOut;                              // console output handle

VOID main(int argc, char *argv[])
{
    char buffer[INPUTSIZE];                  // keyboard input buffer

    FreeConsole();                           // discard inherited console
    if(!AllocConsole())                      // and create a new one
        exit(TRUE);                          // allocation failed, exit

    // open handles for console input and output
    hConIn =  CreateFile("CONIN$", GENERIC_READ | GENERIC_WRITE,
                         FILE_SHARE_READ | FILE_SHARE_WRITE,
                         NULL, OPEN_EXISTING, 0, NULL);
    hConOut = CreateFile("CONOUT$", GENERIC_READ | GENERIC_WRITE,
                         FILE_SHARE_READ | FILE_SHARE_WRITE,
                         NULL, OPEN_EXISTING, 0, NULL);

    // bail out if we can't get console I/O handles
    if((hConIn == (HANDLE) -1) || (hConOut == (HANDLE) -1))
        exit(TRUE);

    getComspec(comspec);                     // get pathname for CMD.EXE

    while(TRUE)                              // main interpreter loop
    {
        getCommand(buffer);                  // get command from user
        if(!intrinsic(buffer))               // if intrinsic, run worker
            extrinsic(buffer);               // else pass to CMD.EXE
    }
}

//
//  intrinsic() -- try and match user's command with intrinsic
//  command table.  If a match is found, run the associated routine
//  and return TRUE, else return FALSE.
//
UINT intrinsic(char *input)
{
    int i;                                   // scratch variable
    char token[64];                          // scratch buffer

    // discard leading blanks from user's input
    while(*input == '\x20') input++ ;

    i = strcspn(input, " ;/,-");             // search for delimiter
    memset(token, 0, sizeof(token));         // zero out token buffer
    strncpy(token, input, i);                // copy first input token
    strupr(token);                           // fold token to upper case

    for(i=0; i < dim(commands); i++)         // search command table
    {
        if(!strcmp(commands[i].name, token))
        {
            (*commands[i].fxn)(input);       // if match, run routine
            return(TRUE);                    // and return true
        }
    }
    return(FALSE);                           // no match, return false
```

Figure 2: **This simple, table-driven shell for NT uses the Win32 console API.**

NTSHELL.C

2 of 2

```
}

//
//  extrinsic() -- process an unrecognized command by passing
//  it to a child instance of CMD.EXE.
//
VOID extrinsic(char *input)
{
    if(system(input))                       // run child CMD.EXE
        putMsg(msg2);                       // error message if failed
}

//
//  getCommand() - issue prompt, get user's command from console,
//  and make it ASCIIZ.
//
VOID getCommand(char *buffer)
{
    DWORD count;

    putMsg("\nntshell: ");                  // display prompt
    ReadFile(hConIn, buffer, INPUTSIZE, &count, NULL);
    buffer[count-2] = 0;                    // clip off CR-LF
    strupr(buffer);                         // fold to upper case
}

//
//  getComspec() -- get the full pathname for CMD.EXE
//  from the "COMSPEC=" variable in the environment.
//
VOID getComspec(char *buffer)
{
    strcpy(buffer, getenv("COMSPEC"));      // get COMSPEC variable
                                            // from environment
    if(!buffer[0])
    {                                       // if no such variable,
        putMsg(msg3);                       // display error message
        exit(1);                            // and exit
    }
}

//
// putMsg() -- display a string on the console.
//
VOID putMsg(char *string)
{
    DWORD count;

    WriteFile(hConOut, string, strlen(string), &count, NULL);
}

//
//  These are the subroutines for NTSHELL's intrinsic commands.
//

VOID doCls(char *input)                     // CLS command =
{                                           // erase the window
    DWORD count;
    COORD coord;
    CONSOLE_SCREEN_BUFFER_INFO si;

    GetConsoleScreenBufferInfo(hConOut, &si); // get screen dimensions

    coord.X = 0;                            // buffer coordinates for
    coord.Y = 0;                            // start of blanking = (0,0)

   // fill screen with blanks, set cursor at upper left corner
   FillConsoleOutputCharacter(hConOut, ' ', si.dwSize.X * si.dwSize.Y,
        coord, &count);
    SetConsoleCursorPosition(hConOut, coord);
}

VOID doDos(char *input)                     // DOS command = start
{                                           // child copy of CMD.EXE
    if(spawnlp(P_WAIT, comspec, comspec, NULL))
        putMsg(msg1);                       // error message if failed
}

VOID doExit(char *input)                    // EXIT command =
{                                           // terminate NTSHELL
    exit(FALSE);                            // with success status
}
```

One of the more interesting characteristics of the console interface is that each console window has a screen buffer associated with it, and the size of this buffer does not necessarily correspond exactly to the window size (though it can't be smaller). The buffer is viewed as a two-dimensional array of characters and attributes; the characters are 8 bits if the program is using ASCII, or 16 bits if the program is UNICODE-aware. The buffer size can be varied dynamically, and the visible portion of the buffer can be controlled by changing the window origin. The program can also allocate more than one screen buffer per console and switch between them at will (for example, to flip the window contents from the application's main interface to a help interface and back again).

A CONSOLE I/O EXAMPLE In order to provide an elementary but practical example of Win32 character I/O, I've modified the SHELL.C program in my ill-fated OS/2 book to create a new program called NTSHELL.C. The source code for NTSHELL is shown in Figure 2; the complete source code, header file, make file, and executable program can be downloaded from the Programming forum of PC MagNet, archived as NTS1.ZIP.

NTSHELL is a simple, table-driven command processor. It prompts the user for a line of input, then looks up the first token of the input in the table commands[]. If NTSHELL finds a match, it runs the corresponding routine whose address is in the table. Otherwise it passes the input to a child copy of CMD.EXE (the NT command-line processor). CMD.EXE, in turn, will either process the input as one of its internal commands, run an .EXE or batch file, or issue an error message.

In its current form, NTSHELL only recognizes three internal commands: CLS, DOS, and EXIT. CLS causes NTSHELL to clear its console window and position the cursor in the upper-left corner of the window (the home position). The DOS command causes NTSHELL to run a child copy of CMD.EXE and wait until the user terminates the child by typing EXIT. Finally, EXIT causes NTSHELL itself to terminate, passing control back to the program that launched it (usually CMD.EXE).

NTSHELL illustrates the use of several different console API functions. It discards the default console with FreeConsole(), obtains a new console—and hence a new output window—with AllocConsole(), and opens input and output handles with CreateFile(). NTSHELL then uses the generic I/O functions ReadFile() and WriteFile() to obtain strings from and display strings to the user. It also uses GetConsoleScreenBufferInfo(), FillConsoleOutputCharacter(), and SetConsoleCursorPosition to implement the CLS command.

To remain focused on the subject at hand, I've used the standard C runtime functions spawn() and system() rather than Win32 functions to execute CMD.EXE. In the next issue, we'll turn our attention to Win32's multitasking API, and modify NTSHELL to make explicit use of the WIN32 process and thread control functions.

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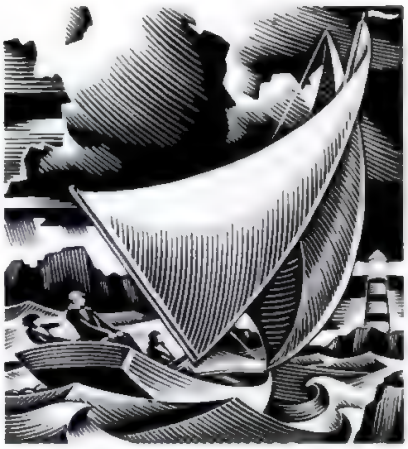

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DATABASES

Updating GET Values: This technique for updating on-screen GET values takes advantage of new features of the GET object class in Clipper 5.0.

BY SAL RICCIARDI

Updating GET Values

I have created a function in Clipper 5.01 that updates a value on the screen displayed by the @. . .GET command. It can be used with great success in the VALID clause of GET commands to change values in related data entry fields. The syntax is simple:

```
UpdateGet( cGetName, uValue )
```

where *cGetName* is the variable name of the GET to update and *uValue* is the value to place in that field. The function places the passed value in the correct variable and redisplays the field. The name of the GET to be changed must include an alias if one was specified when the GET was first issued.

The UpdateGet() function uses the ASCAN() function to search the GetList array for the named GET. If it is found, the GET object is assigned to the variable oGet and the methods VARPUT() and DISPLAY() are used to assign and display the new value. The function returns a logical TRUE if the named GET was found, FALSE if it was not.

Joe Wirtley
Seven Mile, Ohio

▶PC MAGAZINE Imagine that you'd like to display a price in an editable field based on a product choice that a user makes. In the first data entry field, or GET, a user enters the product choice. This is followed by several other data entry fields, and finally by the entry field for the price.

A good approach is to attach a VALID routine to the first GET, the one for the product choice. You'll recall that a VALID routine executes when an attempt is made to leave the GET field and is usually used to validate the data that a user entered. If the data is not valid, the routine should return FALSE, which tells the READ mechanism to prevent a user from leaving the field. It can also be used to perform any other "on-the-way-out" processing that makes sense. As long as the VALID routine returns TRUE, processing continues.

> ***Clipper preprocesses every GET statement into a function call that creates a new GET object and adds it to a public array called GetList.***

Within the product choice VALID routine, you assign a new default value to the price variable, depending on which product is chosen. Normally, however, Clipper doesn't update the screen to reflect the new default price until you move the cursor into the price field, which is way down on the bottom of the screen. This means that while a user is working in those other fields that come before the price field, the old price remains on the screen.

This demonstrates how the UpdateGet() function can be really helpful. You can use UpdateGet() to refresh the price that is displayed on the screen right after the product choice is processed, instead of having to wait for the user to step all the way down to the price field.

The UpdateGet() function requires that the variable name you pass it be specified in exactly the same manner as it was in the GET statement, including any work area aliases. Assuming that you named the price variable nPrice, the following code would update the price GET on-screen when placed in the VALID routine for the product choice:

```
UpdateGet( nPrice, newvalue )
```

where *newvalue* is the new price.

To use the UpdateGet() function, you pass it the variable name of the GET to update as well as the value to assign to the variable. I modified Mr. Wirtley's function in order to make passing the value optional. This way you can assign a new value to the variable directly, and then you can call the UpdateGet() function later when you want to update the display.

For example, to change the price to $1.89, you can use either:

```
UpdateGet( nPrice, 1.89 )
```

or

```
price = 1.89
. . .
UpdateGet( nPrice )
```

Clipper preprocesses every GET statement into a function call that creates a new GET object and adds it to a public array called GetList. A GET object is an instance of the GET class, one of three predefined object classes in Clipper 5.01. (The other two are TBROWSE and ERROR.)

The GET class defines a set of opera-

UpdateGet()
Complete Listing

```
*****************************************************************
* UpdateGet( cGetName, uValue ) or                    Clipper 5.01
* UpdateGet( cGetName )
*
* This function will update the value of a GET currently
* displayed on the screen and redisplay the GET.
*
* cGetName is is the name of the GET to update.  The name
* must be specified exactly as it was when the get was issued.
* For example, if a get is issued as item->quantity and you
* try the statement:
*
*     UpdateGet( "quantity", 5 )
*
* it will fail. In this case, you must specify the complete
* alias as it was specified in the @ GET statement,
* item->quantity. The name specified is NOT case sensitive.
*
* uValue is the new value to place in the get.
*
* Returns .T. if the get was found and the value set,
*  .F. otherwise.
*****************************************************************
FUNCTION UpdateGet( cGetName, uValue )
LOCAL oGet, nPos
IF ( nPos := ASCAN( GetList, { ¦ e ¦ UPPER( e:name ) == ;
     UPPER( cGetName ) } ) ) > 0
   oGet := GetList[ nPos ]            // Access the GET object
   IF PCOUNT() > 1                    // If uValue was passed
     oGet:VARPUT( uValue )            // Send it the update msg
   ENDIF
   oGet:DISPLAY()                     // Send it the display msg
ENDIF
RETURN ( nPos > 0 )                   // .T. if found, otherwise .F.

*****************************************************************
* UpdateGets()                                        Clipper 5.01
* Display the current values of all GETS in GetList
*****************************************************************
FUNCTION UpdateGets()
AEVAL( GetList, {¦oGet¦ oGet:DISPLAY() } )
RETURN NIL
```

***Figure 1:* A Clipper 5.01 function that refreshes a specified GET.**

tions called *methods* that can be performed on a GET object. To invoke a method on a GET object, you send the GET object a message using the send operator (:). For example, consider the following code:

```
oGet := GetList[ 1 ]
oGet:VARPUT( 100 )
```

The first line obtains a reference to the GET object stored in the first element of the GetList array. The second line sends a message to the object referenced by oGet, requesting that the VARPUT method be invoked. The VARPUT method assigns a new value to the GET object's variable, in this case 100.

The UpdateGet() function, as shown in Figure 1, works in a similar fashion, by obtaining a reference to the desired GET object and then sending messages to request that methods be invoked on the object. It begins by calling the ASCAN() function to look for the requested GET variable in the GetList array. The ASCAN() function loops through the GetList array, executing a code block for each element. Here each GET object's name variable is compared with the desired name to see if they match. If there is a match, the code block returns TRUE and the ASCAN() function returns the element number in GetList where the match was found. If no match is found, ASCAN returns 0 and the function returns FALSE.

Next, the function obtains a reference, called oGet, to the matching GET object and sends the object some messages. If a value was passed to the function (determined by checking whether the parameter count is greater than 1), the VARPUT message is sent. The VARPUT method assigns a new value to the GET object's variable. Then the DISPLAY message is sent. The DISPLAY method displays the GET object's current value on the screen.

There may be times when you'd like to update all the data entry fields at once instead of just a specific one. The following code does just that:

```
AEVAL(GetList,
{¦oGet¦ oGet:DISPLAY() })
```

Here the AEVAL() function loops through each element of the GetList array, sending each GET object the DISPLAY message.

You can place this code in a function called UpdateGets(), which can easily be called from a VALID routine. The function is shown in Figure 1.

FoxPro has a command called SHOW GETS that performs the same function, updating all of the GETs currently displayed on the screen. Using Clipper's preprocessor, you could emulate this command using the following statement (note that this is not a complete emulation, just an example):

```
#COMMAND SHOW GETS =>
 UpdateGets()
```

This tells the Clipper preprocessor to automatically translate any SHOW GETS commands in your source code into calls to the UpdateGets() function.

The functions shown in Figure 1 are available for downloading from the Utilities/Tips Forum of PC MagNet, as UPDGET.PRG. Look in the Databases section. □

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LANGUAGES

Extending Heap Space: The UMB_HEAP unit links as many as four chunks of upper memory into the available heap list of any Turbo Pascal program.

EDITED BY SHARON TERDEMAN

Extending Heap Space

I've written a unit called UMB_HEAP (Figure 1) that can benefit any Turbo Pascal programmer who uses dynamic variables or creates large programs that use overlays. The unit allows Turbo Pascal 6.0 to extend its heap space into upper memory blocks (UMBs), which provides up to 200K more memory for programs to work with. It takes advantage of the linked list structure of the TP6 heap and the UMB functions available through DOS 5.0 when used in conjunction with an upper memory manager like QEMM386 or EMM386. UMB_HEAP works with the integrated development environment and in standalone programs as well.

When using UMB_HEAP, make sure that you actually have upper memory blocks available. One way to verify this is to type the command MEM /C, which lists your computer's use of available memory. If no UMBs are shown, check to make sure that your memory management program is set up properly. For QEMM386 and EMM386, the keyword RAM must be used when installing the device from your CONFIG.SYS file.

To use UMB_HEAP, just include UMB_HEAP in the USES statement of your main program and call the procedure EXTEND_HEAP.

Brian D. Webb
Baytown, Texas

▶PC MAGAZINE The DOS 5.0 UMB functions this unit relies on are the same ones used in Jeff Prosise's UMBFILES utility. (See the November 26, 1991, issue of *PC Magazine* for details.) UMB_HEAP sim-

UMB_HEAP.PAS

1 of 2

```
UNIT UMB_Heap;
(**) INTERFACE (**)
CONST Max_Blocks = 4;
  { It's not likely more than 4 UMBs are needed }
TYPE
  UmbDataType = Array[1..Max_Blocks] of Word;

  PROCEDURE Extend_Heap;
  { Use Upper Memory Blocks to extend the heap }
  PROCEDURE GetBlockSizes(VAR US : UmbDataType);

(**) IMPLEMENTATION (**)

TYPE
{  From pg. 216 of the TP6 programmer's guide.  }
{  It's used for traversing the free blocks of  }
{  the heap.                                    }
  PFreeRec = ^TFreeRec;
  TFreeRec = RECORD
    Next : PFreeRec;
    Size : Pointer;
  END;

VAR
  Block_Segments : UmbDataType;
    { UMB starting segments }
  Block_Sizes    : UmbDataType;
    { UMB sizes             }
  SaveExitProc : Pointer;

FUNCTION UMB_Driver_Present : Boolean;
  { See if a UMB-capable driver is present. }
VAR Flag : Boolean;
BEGIN
  Flag := False;
  ASM
    mov ax,$4300
    int $2F
    cmp al,80h
    jne @Done
    inc [Flag]
  @Done:
  END;
  UMB_Driver_Present := Flag;
END;

PROCEDURE Allocate_UMB;
{ Add the four largest UMBs to the heap }
VAR
  i,
  Save_Strategy,
  Block_Segment,
  Block_Size : Word;
BEGIN
  FOR i := 1 to Max_Blocks DO
  { Assume that no blocks will be selected }
    BEGIN
      Block_Segments[i] := 0;
      Block_Sizes[i] := 0;
    END;
  ASM
    mov ax,5801h
    mov bx,0040h
    int 21h       { Set the DOS allocation strategy to }
    mov ax,5803h  { uses only high memory               }
    mov bx,0001h
    int 21h       { Set the UMB status to add UMBs }
  END;
  FOR i := 1 to Max_Blocks DO
    BEGIN
      Block_Segment := 0;
      Block_Size := 0;
      ASM
        mov ax,4800h
        mov bx,0FFFFh
        int 21h  { Get the size of the next largest UMB }
        cmp bx,0
        je @Fail
        mov ax,4800h
        int 21h              { Get the next largest UMB }
        jc @Fail
        mov [Block_Segment],ax
        mov [Block_Size],bx
      @Fail:
      END;
      { Save the UMB's size and addr }
      Block_Segments[i] := Block_Segment;
      Block_Sizes[i] := Block_Size;
```

Figure 1: **This unit links as many as four upper memory blocks into a Turbo Pascal program's list of available heap memory.**

UMB_HEAP.PAS

2 of 2

```
    END;
END;

PROCEDURE Release_UMB; FAR;
{ Exit PROCEDURE to release UMBs }
VAR
  i,
  Segment : Word;
BEGIN
  ExitProc := SaveExitProc;
  ASM
    mov ax,5803h
    mov bx,0000h
    int 21h  { Set the UMB status to release UMBs }
  END;
  FOR i := 1 to Max_Blocks DO
    BEGIN
      Segment := Block_Segments[i];
      IF (Segment > 0) THEN
        ASM
          mov ax,$4901
          mov bx,[Segment]
          mov es,bx
          int 21h                  { Release the UMB }
        END;
    END;
END;

FUNCTION Pointer_To_LongInt(P : Pointer) : LongInt;
TYPE
  PtrRec = RECORD
    Lo, Hi : Word;
  END;
BEGIN
  Pointer_To_LongInt :=
    LongInt(PtrRec(P).Hi)*16+PtrRec(P).Lo;
END;

PROCEDURE Extend_Heap;
VAR
  i    : Word;
  Temp : PFreeRec;
BEGIN
  IF UMB_Driver_Present THEN
    BEGIN
      Allocate_UMB;
      Temp := HeapPtr;
      i := 1;
      WHILE ((Block_Sizes[i] > 0) AND
             (i <= Max_Blocks)) DO
        BEGIN
          Temp^.Next := Ptr(Block_Segments[i],0);
          Temp       := Temp^.Next;
          Temp^.Next := HeapPtr;
          Move(Block_Sizes[i], Temp^.Size,SizeOf(Word));
          Temp^.Size := Pointer(LongInt(Temp^.Size)
            SHL 16);
          Inc(i);
        END;
      IF (Block_Sizes[1] > 0) THEN
        FreeList := Ptr(Block_Segments[1], 0);
    END;
END;

PROCEDURE GetBlockSizes(VAR US : UmbDataType);
BEGIN
  US := Block_Sizes;
END;

BEGIN
  FillChar(Block_Sizes, SizeOf(Block_Sizes), 0);
  SaveExitProc := ExitProc;
  ExitProc := @Release_UMB;
END.
```

TESTUMB.PAS

Complete Listing

```
PROGRAM TestUmb;
USES DOS, Umb_Heap;
VAR
  US : UmbDataType;
  N  : Word;
BEGIN
  IF Lo(DosVersion) < 5 THEN
    BEGIN
      WriteLn('UMB_HEAP requires DOS 5.0 or later');
      Halt;
    END;
  WriteLn('Before Extend_Heap, MemAvail=',
    MemAvail, ' and MaxAvail=', MaxAvail);
  Extend_Heap;
  WriteLn('After  Extend_Heap, MemAvail=',
    MemAvail, ' and MaxAvail=', MaxAvail);
  GetBlockSizes(US);
  FOR N := 1 to Max_Blocks DO
    IF US[N] > 0 THEN
      WriteLn('UMB Block #',N,' contains ',
        US[N]*16, ' bytes.');
END.
```

Figure 2: **This program tests the UMB_HEAP unit, reporting on the increase in available heap memory and the size of the individual UMBs added.**

ply links the available UMBs into a Turbo Pascal program's list of available heap memory. The example program, TESTUMB.PAS shown in Figure 2, demonstrates the use of this unit. (You can download UMB_HEAP and TESTUMB from PC MagNet as UMB_HE.ZIP.) Note that while MemAvail (the total available heap memory) increases after the call to Extend_Heap, MaxAvail (the largest block of heap memory) does not.

I added the procedure GetBlockSizes to the UMB_HEAP unit; it fills a data structure in the calling program with the sizes of up to four UMB blocks. If GetBlockSizes returns a structure filled with zeros, Extend_Heap didn't succeed in allocating UMBs. Either the DOS version is earlier than 5.0, no UMBs are available, or all UMBs are already in use.

Controlling the Floppy Disk Drive

I wrote a program that can tell whether a floppy disk has been changed in a drive so that the user doesn't have to press a key to alert the program he has done so. DISKETTE.C, shown in Figure 3, prompts you to remove the current disk or to insert a new disk. The program makes the assumption that the floppy disks have been formatted.

Ferdinand Purnomo
Jakarta, Indonesia

▶PC MAGAZINE At one time or another, everyone has used a software installation program that prompts you for the next floppy disk without waiting for a keystroke: The program tells you to remove one disk, then to insert another, and knows when you've followed through without your ever touching the keyboard. How does it work?

DOS doesn't provide any services for establishing whether a floppy disk has been replaced; to determine this, your application will have to use the BIOS disk services. Fortunately, Microsoft C 6.0 and 7.0 and Borland C++ 3.0 provide a function, _bios_disk, that can provide access to these types of floppy disk drive operations. (If you use a Borland C com-

DISKETTE.C
Complete Listing

```
// diskette.c

#include<stdio.h>
#include<bios.h>
#include<ctype.h>
#include<stdlib.h>

void main(int argc, char **argv)
    {
    struct diskinfo_t disk;
    int counter = 0;

    if(argc > 1)
        disk.drive = toupper(*argv[1])-'A';
    else
        disk.drive = 0;

    disk.head     = 0;  // set to read beginning of disk. . .
    disk.track    = 0;
    disk.sector   = 1;
    disk.nsectors = 1;

    for(counter = 0; counter < 3; counter++)
        {
        _bios_disk(_DISK_RESET, &disk);      // reset disk controller
\                                            // verify disk sectors
        if(!(_bios_disk(_DISK_VERIFY, &disk) >> 8))
            {
            printf("Please remove diskette in drive %c. . .\n",disk.drive+'A');
                // loop until disk is removed
            while(!(_bios_disk(_DISK_VERIFY, &disk) >> 8))
                ;
            break;
            }
        }

    printf("Please insert a diskette into drive %c. . .\n",disk.drive+'A');

    _bios_disk(_DISK_RESET, &disk);      // reset controller again
            // loop until disk is inserted
    while(_bios_disk(_DISK_VERIFY, &disk) >> 8)
        _bios_disk(_DISK_RESET, &disk);

    printf("Thank you.\n");
    exit(0);
    }
```

Figure 3: **This program tells you when to insert a new disk in your floppy disk drive.**

piler earlier than BC++ 3.0, you'll have to use the biosdisk function, which is similar but not completely compatible with _bios_disk.)

The _bios_disk function takes two parameters: a command argument and a pointer to a diskinfo_t structure (defined in BIOS.H). You use the command argument to tell the function what to do and the pointer to indicate the part of the disk on which to do it. Using _bios_disk to identify disk changes is a matter of using the _DISK_RESET and _DISK_VERIFY commands with _bios_disk: You reset a floppy disk drive, then loop until the verify operation is successful.

If a call to _bios_disk is successful, the function will return zero in the high byte of the return value. Thus, the verify loops might look like

```
while(!(_bios_disk(_DISK_VERIFY,
 &disk) >> 8));
```

DISKETTE.C provides a good demonstration of how to use the function. I modified it only slightly: Rather than hardwiring it to use drive A, I changed it so that you can pass an *a* or *b* as a command-line argument. Thus,

```
DISKETTE a
```

will run the program using drive A, and

```
DISKETTE b
```

will run the program using drive B.

If there's a floppy disk in the designated drive, the program will detect its presence and tell you to remove it. Once you do, it will prompt you to insert another disk in the drive. When you've inserted the new disk, the program terminates.

Note the program loop I added around the code that initially tests for the presence of a floppy disk. The ROM BIOS doesn't automatically wait for a disk drive to get up to speed before attempting a _DISK_VERIFY operation. This can result in an error if the drive motor happens to be off at the time of a _DISK_VERIFY. Thus, any program that uses _DISK_VERIFY should reset the floppy disk controller and retry the verify operation three times if the disk verify operation fails.

Without this loop, you'd notice the problem if you rebooted your computer and then ran DISKETTE on a drive that hadn't been accessed during that session. The loop ensures that the _DISK_RESET operation is called at least three times before the program assumes that there really isn't a floppy disk in the appropriate drive.

You can compile DISKETTE.C with Microsoft C, Versions 6.0 and 7.0, using the line

```
CL diskette.c
```

or use

```
BCC diskette.c
```

with Borland C++ 3.0 or 3.1. You can find DISKETTE in the Programming Forum on PC MagNet; it's archived as DISKET.ZIP.—*Richard Hale Shaw*

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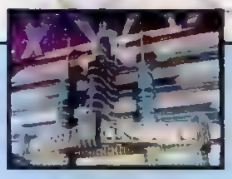

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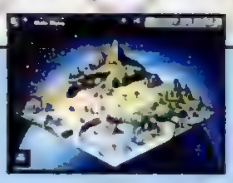

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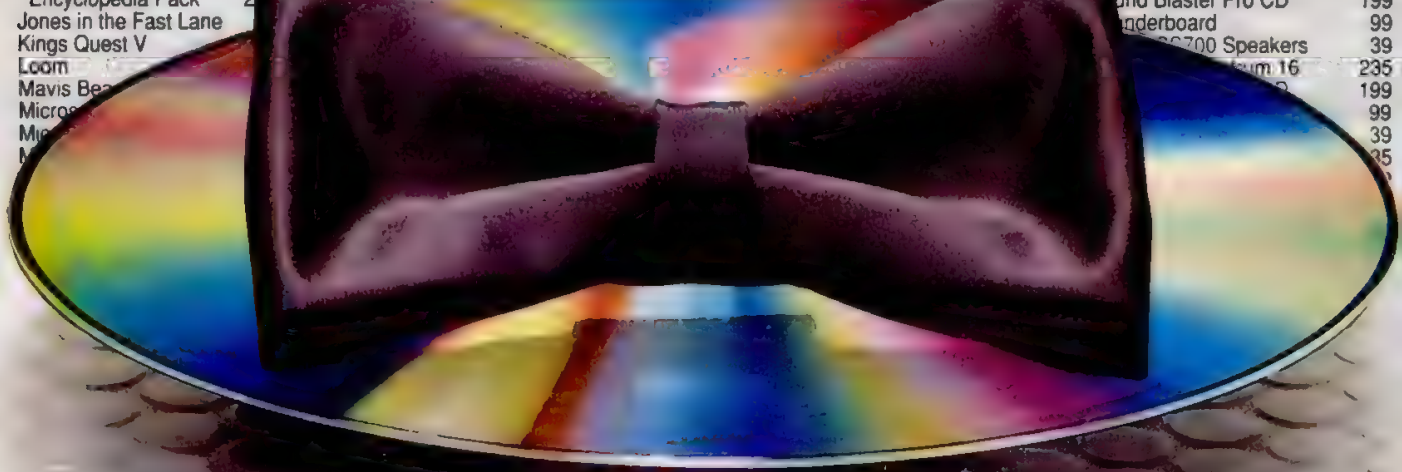

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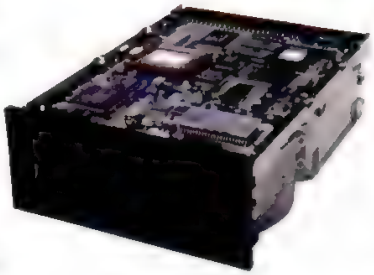

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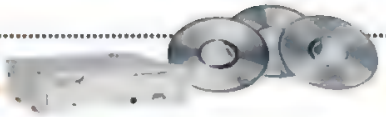

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BY JOE SALEMI

Automatically Setting the Clock

I know there's a program that dials into the Atomic Clock to set the system time on Macintosh systems automatically. I've been trying to find a similar program that will set the network time on a NetWare file server. Are you aware of such a program?

Leonard Johnson
New York, New York

▶**PC MAGAZINE** I found three PC-based shareware programs that call and set the system clock, but they all run under DOS and will only work on a nondedicated NetWare 2.*x* server. These programs obtain the exact time by calling either the official U.S. time clock at the United States Naval Observatory (USNO) in Washington, D.C., or the National Institute of Standards and Technology (NIST) in Boulder, Colorado. The NIST provides the time, accurate within 10 milliseconds, by way of a modem and three shortwave-band radio stations.

PCCLOCK Digital Clock (M.J. Sadaway, Box 128-P, South Walpole, MA 02071) calls only the NIST, either automatically or manually, and displays a clock that can be set to show the date, time (in 12- or 24-hour format), or alternating date and time. You can change the design of the clock to any of 80 preset color combinations, or you can create your own. The program also has an alarm and a feature that makes the clock chime every hour. PCCLOCK is available in Library 14 (ASP Utils) of the PC MagNet Utilities/Tips Forum as PCLOCK.ZIP. The registration fee is $10.

Another time-setting utility is TimeSync (SolaCamp Software, P.O. Box 4464, Lutherville, MD 21094; $7.50 registration fee). TimeSync can call either the USNO or the NIST and can be run in automatic mode or manually through a drop-down menu interface that supports a mouse. It has the ability to adjust for line delay when you call the NIST, giving a more accurate time setting, and has a menu option that lets you set an add-on clock on PC and XT-class systems that don't automatically set their internal clocks when you change the DOS date and time. You can find TimeSync in Library 16 (Gen Utils) of the PC MagNet Utilities/Tips Forum as TIMESY.ZIP.

The most complex and consequently most expensive of the three programs is TIMESET (Life Sciences Software, 8925 271st N.W., #112, P.O. Box 1560, Stanwood, WA 98292; 206-387-9788). TIMESET costs $35 for registration but has support for calling either the NIST or the USNO, with or without a measured adjustment for line delay. It supports systems with add-on clocks and contains a device driver that can be used to automatically set the date and time in these add-ons. TIMESET can be run in manual or batch mode. Look for TIMSET.ZIP in Library 16 (Gen Utils) of the PC MagNet Utilities/Tips Forum.

If you're a Windows 3.*x* or OS/2 2.0 user, you can also use the WTIME utility that appeared in the October 27, 1992, issue of *PC Magazine*. WTIME dials only the NIST, and can be run manually or as part of your Windows startup sequence. WTIME can be downloaded from Library 2 (PCMag Utilities) in the PC MagNet Utilities/Tips Forum.

As noted, these programs only work on a nondedicated NetWare 2.*x* server. If you have a dedicated 2.*x* server, you'll have to run the time-setting utility on one of the network workstations in automatic (sometimes called batch) mode and then use the appropriate NetWare utility to set the file server's time from the workstation's clock. On a NetWare 3.*x* system, you can run the utility as part of the boot sequence, before starting up the network operating system. (NetWare 3.*x* boots DOS first and then loads the network.) In any case, you'll need a 1,200-bps (or faster) modem.

Astronomy Software

I am hoping you can help me find a particular program I've heard about. It's called Dance of the Planets, by A.R.C. Science Simulation.

Ron van der Wees
Toronto, Ontario
Canada

▶**PC MAGAZINE** Dance of the Planets is a solar-system simulator from A.R.C. Science Simulation (P.O. Box 1955, Loveland, CO 80539; 800-759-1642, 303-663-3223; $195) that includes 3-D viewing and animation of user-selected planetary systems. A sample is shown in Figure 1. It requires an EGA monitor or better and 640K of RAM, and supports EMS and a math coprocessor. Your letter wasn't very specific about what you wanted the

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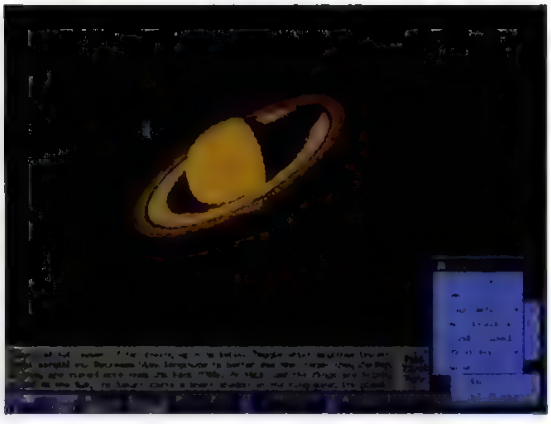

Figure 1: A view of Saturn, created with Dance of the Planets.

astronomy software for, so I found a few other astronomy programs that may also fit your needs. Personal Microcosms (8547 E. Arapahoe Rd., Suite J-147, Greenwood Village, CO 80112; 303-753-3268) puts out two programs: Astronomy Lab for MS-DOS ($59.95 plus $2.95 shipping and handling) and Astronomy Lab for Windows ($30 registration).

Both packages produce animation sequences and graphs that show the current Earth sky, as well as other information on the solar system. The DOS version requires at least an EGA monitor and 512K of RAM. The Windows version is shareware and is available in the After-Hours Forum on PC MagNet as ASTLAB.ZIP.

Another product that shows the current positions of the stars and planets is Sky (Software Bisque; 912 12th St., Suite A, Golden, CO 80401; 800-843-7599, 303-278-4478). It requires 640K of RAM, and it supports creating star charts that can be used for positioning a telescope. It can also be used to plot eclipses and search for objects. The price varies depending on the number of stellar objects: $75 for 10,000; $99 for 45,000; and $175 for 272,000. Sky for Windows has the same features and uses the same databases. It costs $99 for 10,000 objects; $129 for 45,000; and $199 for 272,000.

Home Design Software

I am going to build a new house in the near future. Are there any graphics programs that deal exclusively with designing your own house?

David B. Johnson
Lansing, Michigan

▶PC MAGAZINE Architectural design is a traditional use for CAD programs, but a full-fledged CAD program can be cumbersome to learn as well as costly. For example, the latest version of Autodesk's AutoCAD (2320 Marinship Way, Sausalito, CA 94965; 800-445-5415, 415-332-2344) retails for $3,500.

Autodesk Retail Products (11911 N. Creek Pkwy., Bothell, WA 98011; 800-228-3601, 206-487-2233) also sells simpler CAD programs called Generic CAD 6.0 ($495) and Generic 3D ($349). 3D Basic Home Design, a library of over 100 common design components that works with Generic 3D, retails for $75. Autodesk's Home Series includes packages that cover Home Design, Kitchen, Bathroom, and Landscape Design ($59.95 each). The Home Design package may be more than adequate for your needs.

Another popular package is FloorPlan Plus (ComputerEasy International Inc., 414 E. Southern Ave., Tempe, AZ 85282; 800-522-3279, 602-829-9614; $79.95), which comes with a library of over 130 predefined objects such as doors, windows, and furniture. You can add objects of your own design to the library for future use. ComputerEasy also sells Estimator Plus ($89.95), which takes the plans you've designed under FloorPlan and estimates the amounts of materials (such as wood and pipes) needed and the total cost. A Windows 3.*x* version of FloorPlan Plus allows you to create up to 16 "layers" of information, each containing a particular portion of your overall design. You can work with the layers individually or combine them to give a complete view of the plan.

Finally, there's the Design Your Own Home Series from Abracadata Inc. (P.O. Box 2440, Eugene, OR 97402; 800-451-4871, 503-342-3030). The series includes three separate programs—Architecture, Interiors, and Landscapes—at $99.95 each. To design a whole house, you'd want the Architecture package.

CAD programs can be very computation-intensive. A fast 80286- or 80386-based PC is a good minimum system, and a math coprocessor helps speed up the drawing times. For accurate representation, you should have at least EGA graphics—VGA is even better. Though all the programs work with the keyboard, a mouse makes it easier to draw and manipulate the objects in your design.

For more information see After Hours in our August 1992 issue.

TV On Your Computer

Is there any way to use a PC like a television? If it's possible, can you tell me what hardware will let me to do it?

Gary Lindahl
Renton, Washington

▶PC MAGAZINE As a matter of fact, there are a few boards that let you watch television through your computer. AView Technology Inc. (2 St. Clair Ave., #1600, Toronto, Ontario, Canada M4V 1L5; 800-263-7288, 416-922-6555) makes 8-bit ISA boards that show full-screen TV images on your EGA or VGA monitor. The DeskTopTV Model MF1 ($395) was reviewed in the April 16, 1991, issue of *PC Magazine*. This board works with EGA or VGA multisync monitors that support a 15-kHz horizontal frequency, which is the same as a television set. The DeskTopTV Model VG1 ($395) is a VGA-only version that provides smoother video images on monitors that support 30-kHz horizontal frequencies. Both boards come with a utility that lets you control the volume, color settings, and channel—just as you would on a TV.

You can also view TV images in a window under Windows 3.1 with the TV/FX, a 16-bit ISA board from STB Systems Inc. (1651 N. Glenville, #210, Richardson, TX 75081; 800-234-4334, 214-234-8750; $695). The board includes an on-board cable-ready tuner and can capture images from the TV so you can import them into graphics applications. It comes with software that lets you adjust the basic TV controls. □

ASK THE ADVISOR

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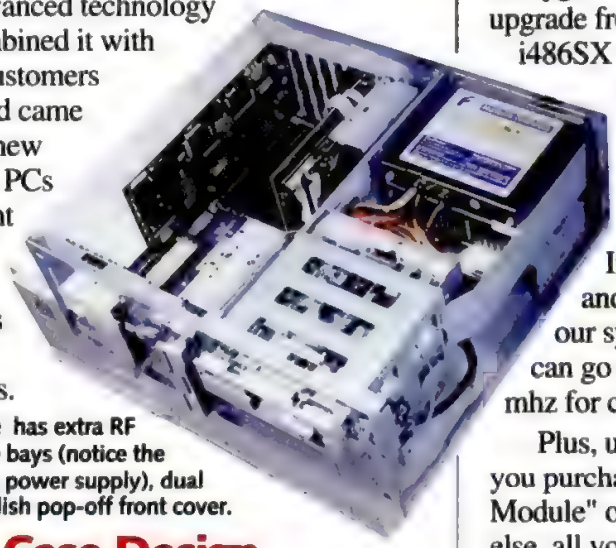
Our Next Generation of 386 & 486 PCs

At FastMicro, we've been building PCs for over six years, in fact, we've been doing it since the day we went into business. So when we sat down to design our most powerful FastData PCs ever, we wanted them to stand apart from the crowd. We utilized the most advanced technology available and combined it with the features our customers asked for most and came out with a whole new line of 386 & 486 PCs that are as different from our previous products almost as much as they are from our competitors' boxes.



Our new desktop case has extra RF shielding, lots of drive bays (notice the seventh bay under the power supply), dual cooling fans and a stylish pop-off front cover.

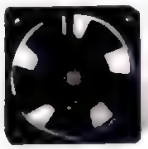
Advanced Case Design

Our new desktop case is uniquely engineered to provide the highest quality and maximum expandability in a space saving design. *It has a total of seven drive bays* to accommodate all of the storage options our customers tell us they want to be able to add in the future. It also has extra protection against electrical interference, unlike the weaker systems others sell.

You won't run out of room when adding new peripherals!

Dual Intelligent Cooling Fans

Intel's new clock doubler chips put out much more heat than its predecessors. Some Overdrive processors even require a heat sink. FastMicro's new desktop PCs come with a second temperature activated fan to dissipate system damaging heat. Not all systems are alike, *FastMicro's last longer!*



FastMicro puts a second fan up front, where the heat is!

The Most Processor Upgradability - All the Way to 100MHz

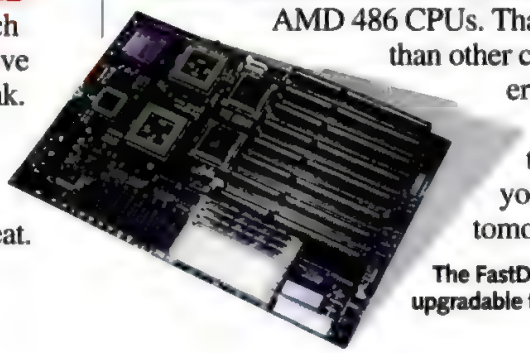
FastMicro protects your investment.

We've designed our new systems to expand upon Intel's ambitious upgrade strategy. While some other systems have no upgrade path and others only let you upgrade from 386DX to 386DX, i486SX to i486SX or i486DX to i486DX (or DX/2), *FastMicro's new systems can be upgraded to any 486 processor* - 486SX or 486DX. So the 486SX you get today can be upgraded to a 486DX or DX/2 tomorrow. Imagine buying a FastData 486DX/33 now and upgrading it to a 100mhz DX/2 later - our systems are designed to do just that. You can go up to a 50mhz clock rate processor (100 mhz for clock doublers).

Plus, unlike some other companies that make you purchase an expensive proprietary "CPU Module" or "Upgrade Card" not available anywhere else, all you have to do to upgrade your FastData 486 is to install a new processor, replace the clock crystal and change some system settings. That's it - no catches.

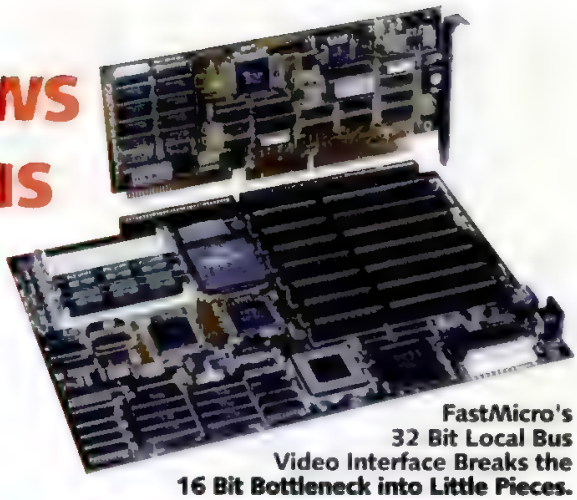
Upgradable 386/40 Too!

The FastData 386-40 is the most upgradable PC on the market! Not only do you get the most power for your money today, but you can upgrade your system to current and future 486 processors. All you do to upgrade is plug in a new processor & a crystal. Processors & crystals are widely available. You can install i486DX, i486DX/2, i486SX, & announced AMD 486 CPUs. That's more flexibility than other companies' computers. FastMicro really maximizes value today and protects your investment tomorrow!



The FastData 386/40 is easily upgradable to 486 processors!

Turbocharge Windows with 486 Local Bus Video Power!



FastMicro's 32 Bit Local Bus Video Interface Breaks the 16 Bit Bottleneck into Little Pieces.

FastMicro's new systems feature the highest performance video options on the market today. From our standard 1mb Super VGA adapter to our highest performance Windows accelerator card - every video option we offer consistently yields the highest possible performance at the lowest possible cost.

Today's Windows environment is very dependent on video speed for overall system performance. The i486 is a high speed 32 bit processor, it handles data in and out in 32 bit chunks at external processor speed (such as 33mhz). The problem is that the ISA bus found in normal systems is 16 bit and only runs at 8 mhz, thus video performance is severely crippled!

FastMicro includes a Non-Interlaced 1024x768 Super VGA monitor.

FastMicro removes the performance limit with its 32 bit high speed local bus. Plug the Local Bus Video Card into the special 32 Bit Slot and Windows flies!

Powerful 170 Mb IDE Hard Drive.

FastMicro includes Conner's CP-30174 170mb IDE hard drive standard in the FastData 386/40. Conner has a reputation for building the most reliable drives on the market, in fact, the CP-30174 has a MTBF (mean time between failures) rating of more than 150,000 operating hours. If you ran your FastData system 24 hours a day - that's more than *17 years*! Couple this with a <17 millisecond access time and 32K built-in cache and you won't want to gamble on a less reputable drive.

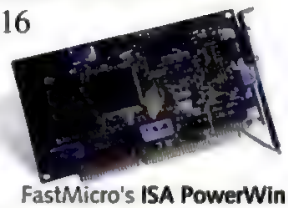
CONNER

Why run out of storage with an average 120mb drive? FastMicro gives you the 50mb bonus.

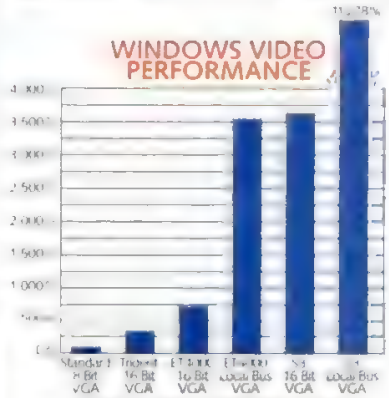
The Highest Performance Video Options

FastMicro lets you choose from several different video cards and monitors to suit your individual application.

Some systems come standard with our Trident 1mb VGA card: it's 16 bit, runs Windows 3 times faster than standard 8 bit video cards and does up to 1024 x 768 at 256 colors. Other systems come standard with our PowerWin™ Hi-Color ISA card. It uses a Tseng Labs ET4000 Windows Accelerator Chip, it's more than twice as fast as the Trident card and it does a maximum of 32,768 colors. Our S3 NuclearWin™ Coprocessor ISA Video Card offloads the video processing from the CPU and, in turn, significantly multiplies performance. It's like having a second computer in your computer!



FastMicro's ISA PowerWin VGA is over seven times faster than standard VGA!



Choose one of our Local Bus 486 PCs and we'll include the Local Bus Version of our PowerWin Accelerator - it screams through Windows graphics. You can also upgrade to the Local Bus Version of the NuclearWin Card - it will run Windows up to 100 times faster than standard VGA Cards. *Fasten your seat belts!*

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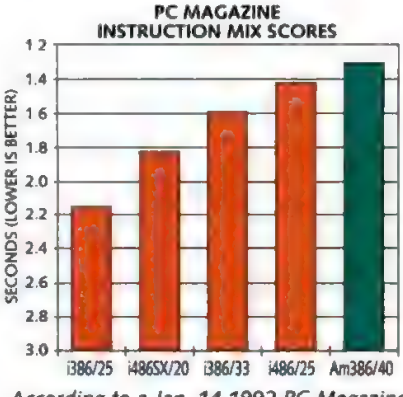
Why settle for anything slower, the 40 mhz Am386DXL from Advanced Micro Devices is the fastest 386 chip on the market, hands down. Not only does it outperform all other 386 chips, it even outperforms many 486 processors too. When looking for a 386 or 486 PC, look for the Am386DXL-40; it's over 20% faster than 33mhz 386 processors, over 31% faster than the Cx486SLC-25, over 50% faster than the i486SX-20, and over 13% faster than the i486SX-25 (in MIPS as tested by Power Meter vers. 1.5). The data speaks for itself - don't pay more and get less.



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Not only is the Am386DXL-40 faster than the i486-25, it's a better value too! The AMD chip costs a lot less than the price of the 486SX and FastMicro passes the savings and performance gain on to you. Plus, there is no sacrifice in upgradablility!

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The Am386 processor family is certified compatible with all 386 compatible hardware and software. It has flawlessly passed tests from every top computer publication and has been tested in over 100 different 386 systems (including FastMicro's) and passed all tests without a single failure or incompatibility. Its compatibility has even been certified by XXCAL Testing Labs.

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The latest high performance 386 processor from Advanced Micro Devices is the Am386SXL-33. It's 32% faster than 25mhz 386SXs and combined with FastMicro's 16K optimized cache, it boosts performance to 74% above normal 386SX-25 levels.

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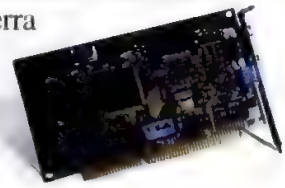

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40mhz Performance	X		
486SX Overdrive Ugr.	X		X
486DX Upgradeable	X		
486DX2 Upgradeable	X		
Cache Upgradeable	X		?
170mb Conner Drive	X		
7 Drive Bays	X		
Dual Cooling Fans	X		
GE On-Site Service	X		
7th Year In Business	X	?	?

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FASTMICRO 486 POWERSTATIONS

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486SX Overdrive Ugr.	X	X	
486DX Upgradable	X		?
486DX2 Upgradable	X		X
586 Upgradable	X		?
High Speed Video	X	?	?
7 Drive Bays	X		
Dual Cooling Fans	X		
GE On-Site Service	X		
Money Back Guarantee	X	X	X
7th Year in Business	X	?	?

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intel inside

For those who need the highest performance Windows workstation at a low cost, the FastData Local Bus 486DX/33 delivers high-speed 486 power, stunning 32 bit local bus video speeds and a large 170mb Conner hard drive at a great price/performance ratio.

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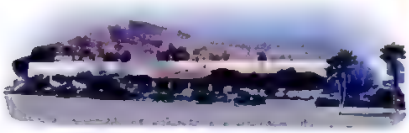

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- i486DX™ 33mhz Processor with 8K Internal Cache & 128K Static Ram Cache.
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- New Generation Desktop Case.
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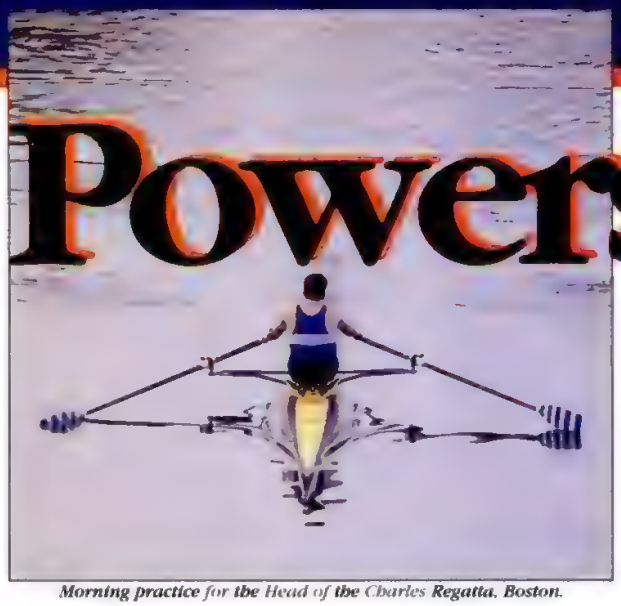

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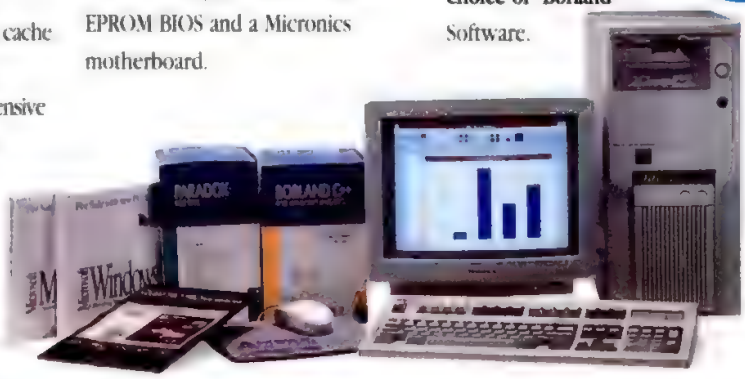

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TUTOR

Testing for DESQview and Windows: This routine detects the presence of Windows or DESQview and can pass that information to a batch file.

BY JEFF PROSISE

SMARTDrive Update

I use the BOOT.BAT batch file and REBOOT.COM utility presented in the May 12, 1992, Tutor column to alternate among several different startup configurations. They worked fine—until I upgraded from Windows 3.0 to 3.1. I traced the problem to the new version of SMARTDrive that comes with Windows 3.1. If I use the old SMARTDrive, BOOT.BAT works just fine. But if I load the new version, BOOT.BAT fails to copy the new CONFIG.SYS and AUTOEXEC.BAT files to the root directory, and the current configuration is booted again. Strangely enough, the COPY commands appear to copy the startup files without any errors. What's wrong?

Roy Hanson
Sunriver, Oregon

▶**PC MAGAZINE** This is an interesting problem, and it highlights one of the major design changes in SMARTDrive 4.0, the version included with Windows 3.1. Here's what's happening.

When you upgraded to Windows 3.1, the Windows setup program copied version 4.0 of SMARTDrive to your hard disk. SMARTDrive 3.*x* (shipped with Windows 3.0 and DOS 5.0) was a read-only disk cache. It buffered data read from the hard disk, but copied data written back out to disk straight through with no intervention. To increase cache performance, Microsoft endowed SMARTDrive 4.0 with a *write-behind* cache (or *delayed-write* cache, as it's called in some texts). When a program writes to your hard disk, SMARTDrive caches the data and waits up to 5 seconds to physically copy it to the disk.

The idea is that your application can get back to business faster because it won't be delayed by a disk access and that the buffered data will be written to disk at the earliest opportune moment. This enhancement is the primary reason that the new SMARTDrive outperforms previous versions.

One implication of using a write-behind cache is that you should never turn off your PC immediately after a disk access. Instead, you need to wait a few seconds to make sure any data held in RAM by SMARTDrive is properly written to the disk. If you'd rather, you can instruct SMARTDrive to flush its write-behind buffers; just type SMARTDRV /C at the DOS prompt. Or, if you don't mind a decrease in cache performance, you can disable write-behind caching for a given drive by specifying the drive letter when you install SMARTDrive. For example, the command

```
SMARTDRV C:
```

instructs SMARTDrive 4.0 to perform SMARTDrive 3.*x*-style read-only caching on drive C:, while the command

```
SMARTDRV C:+
```

enables read and write caching for drive C:. By contrast, the command

```
SMARTDRV C:-
```

disables all caching for drive C:. If you don't specify a drive, SMARTDrive defaults to read caching only for floppy disk drives and to read and write caching for hard disks. CD-ROM drives, network drives, and RAM disks are not cached.

The problem you encountered occurred because BOOT.BAT reboots your PC immediately after it executes a pair of COPY commands to copy the new configuration files to the root directory of drive C:. These configuration files are buffered in SMARTDrive's write-behind cache, and the reboot occurs before the cache is emptied. Thus the files are never actually copied to the hard disk—even though the COPY commands seemed to work. Using RENAME instead of COPY

BOOT4.BAT
Complete Listing

```
@ECHO OFF
IF "%1"=="" GOTO ERROR
IF NOT EXIST C:\SYSTEM\%1.SYS GOTO ERROR
IF NOT EXIST C:\SYSTEM\%1.BAT GOTO ERROR
COPY C:\SYSTEM\%1.SYS C:\CONFIG.SYS >NUL
COPY C:\SYSTEM\%1.BAT C:\AUTOEXEC.BAT >NUL
SMARTDRV /C >NUL
REBOOT

:ERROR
ECHO Syntax: BOOT system, where "system" is the name of the
ECHO         startup files you want to boot from, without the
ECHO         .BAT or .SYS file name extension. Existing startup
ECHO         files are:
DIR C:\SYSTEM\*.SYS
```

Figure 1: **This batch file, which works with SMARTDrive 4.0, flushes the write-behind buffers before rebooting your machine to ensure that all data is written to the disk.**

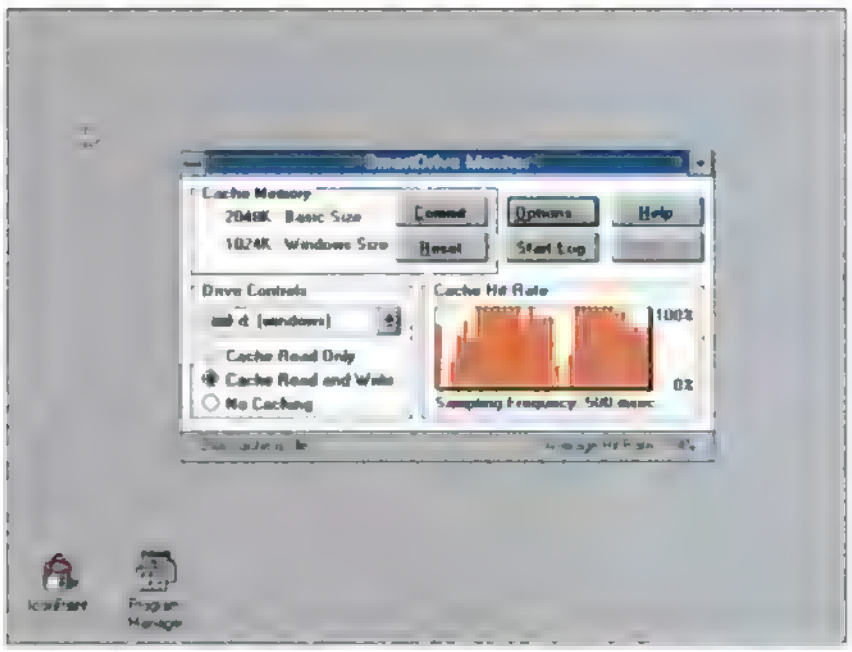

Figure 2: **The SmartMon utility displays SMARTDrive's hit rate and lets users alter SMARTDrive settings interactively.**

doesn't help because, to rename a file, DOS must change the file's directory entry on-disk. This, too, involves a physical disk access, and SMARTDrive would cache that access like any other.

The practical solution is to flush SMARTDrive's write-behind cache *before* rebooting. Figure 1 shows a modified batch file—BOOT4.BAT—designed to work with SMARTDrive 4.0. The only change is the addition of SMARTDRV /C just before the REBOOT command, with the command's output hidden by redirecting it to the NUL driver. This simple change ensures that the configuration files are copied to disk before your PC is restarted.

The addition of write-behind caching logic wasn't the only enhancement Microsoft made to SMARTDrive 4.0. Among other things, the new SMARTDrive will cache floppy disk data (SMARTDrive 3.*x* worked with non-removable drives only), so floppy drive performance is enhanced, too. And the way SMARTDrive hooks into the system has been modified so that the program can monitor the data stream for a wider variety of devices, including some Bernoulli drives, hard cards, SCSI drives, and WORM drives that the older version could not work with.

A further modification, double buffering, eliminates problems that occurred when SMARTDrive 3.*x* was loaded high on some PCs with bus-mastering hard disk controllers. If SMARTDrive is paired with a bus-mastering hard disk controller that doesn't support Microsoft's Virtual DMA Services (VDS) specifications, its track buffers must be located in an area of memory where the read/write addresses are the same as physical addresses (in an upper memory block, these addresses differ). When double buffering is enabled, SMARTDrive reserves about 2.5K of conventional memory for its track buffers, eliminating possible addressing conflicts even if the rest of SMARTDrive is loaded high.

Windows 3.1 users and system administrators may be interested to know that the Windows Resource Kit contains a useful utility called SmartMon (for SMARTDrive Monitor) that graphs the hit rate (the percentage of time that data requested from a drive is delivered from the cache rather than from the physical device) and allows the user to alter SMARTDrive settings interactively. SmartMon's main window is shown in Figure 2. Note the numbers indicating cache size in the upper left corner of the window and the Average Hit Rate indicator in the lower right corner. The window continues to display a numerical value reflecting the average hit rate even when minimized and, if you select the "Always on Top" option, it remains visible at all times, even if another window is active. It's a great tool for evaluating the effectiveness of varying cache sizes.

The Resource Kit contains other useful utilities as well as a treasure trove of previously unpublished information about Windows. It's available directly from Microsoft or from your local Microsoft dealer for the modest sum of $19.95 plus $2.50 shipping and handling; to order, call 800-642-7676. If you're a serious Windows user, you won't want to be without it.

Testing for DESQview and Windows

Can a batch file determine whether it is running under DESQview or Windows? Such information could be useful in aborting programs that are incompatible with these environments or for enabling a batch file to adopt specific conventions relating to the appropriate environment.

Bob White
New York, New York

▶PC MAGAZINE You can do it with the aid of a small utility, WINCHECK.COM, which the DEBUG script shown in Figure 3 will create. WINCHECK returns an exit code that tells you whether Windows or DESQview is running. A return code of 0 means neither is active, 1 indicates that Windows is executing in Real or Standard mode, 2 tells you Windows is operating in 386 Enhanced mode, and 3 lets you know DESQview is running. Note that a 2 will also be returned if Windows/386, Version 2.*x*, is running. A batch file using WINCHECK is shown in Figure 4.

WINCHECK uses three different tests to detect the presence of Windows

DEBUG SCRIPT FOR WINCHECK.COM

Complete Listing

```
A 0100
MOV  AX,4680          ;Check for Windows real
INT  2F               ;  or standard mode
MOV  DL,1
OR   AX,AX
JZ   012C
MOV  AX,1600          ;Check for Windows 386
INT  2F               ;  enhanced mode
MOV  DL,2
OR   AL,AL
JZ   011A
CMP  AL,80
JNE  012C
MOV  AX,1022          ;Check for DESQview
MOV  BX,0
INT  15
MOV  DL,3
CMP  BX,0A01
JE   012C
XOR  DL,DL            ;Neither is running
MOV  AH,4C            ;Exit with return code
MOV  AL,DL            ;  in AL
INT  21

N WINCHECK.COM
RCX
32
W
Q
```

Figure 3: **Using this script as the input to DEBUG produces WINCHECK.COM, a utility for detecting the presence of Windows or DESQview. WINCHECK returns an errorlevel of 3 if DESQview is running, 2 to indicate the presence of Enhanced-mode Windows, and 1 for Windows in Real or Standard mode.**

WINTEST.BAT
Complete Listing

```
@ECHO OFF
WINCHECK
IF ERRORLEVEL 3 GOTO DESQVIEW
IF ERRORLEVEL 2 GOTO WIN_E
IF ERRORLEVEL 1 GOTO WIN_S

ECHO Neither Windows nor DESQview is running
GOTO END

:WIN_S
ECHO Windows is running in real or standard mode
GOTO END

:WIN_E
ECHO Windows is running in 386 enhanced mode
GOTO END

:DESQVIEW
ECHO DESQview is running

:END
```

Figure 4: **WINTEST.BAT gives a simple example of how WINCHECK.COM works in a batch file.**

or DESQview. To test for Windows running in Real or Standard mode, WINCHECK executes an interrupt 2Fh with AX set to 4680h. If on return AX is 0, then Windows is running in Real or Standard mode. To test for Windows running in 386 Enhanced mode (or Windows/386 2.*x*), WINCHECK executes an interrupt 2Fh with AX set to 1600h. On return, any value other than 0 or 80h in AX indicates that Windows is running in Enhanced mode.

To test for DESQview, WINCHECK executes an interrupt 15h with AX set to 1022h and BX set to 0. If DESQview is running, BX returns set to 0A01h. If BX returns set to anything else, then DESQview is not running. This is only valid for DESQview 2.0 or later.

This information comes from an excellent book on the subject called *PC Interrupts: A Programmer's Reference to BIOSes, DOS and Third-Party Calls* by Ralf Brown and Jim Kyle (Addison-Wesley, 1991, $32.95). It documents every known interrupt on the PC, including hundreds that are not officially documented by Microsoft or other parties. If you're interested in writing utilities like WINCHECK or in the subject of interrupts and interrupt functions in general, you'll find this an indispensable guide.

All files mentioned in this column can be downloaded from the Utilities/Tips forum on PC MagNet. Look for WINCHECK.COM listed as WINCHE.COM and WINTEST.BAT listed as WINTES.BAT. □

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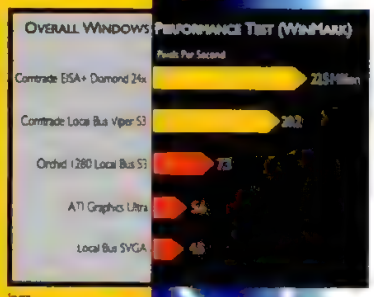

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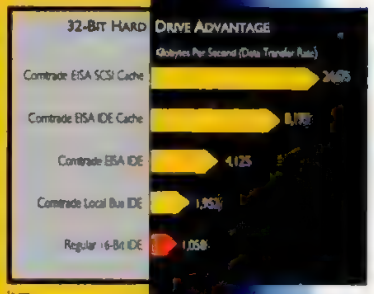

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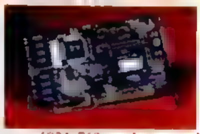
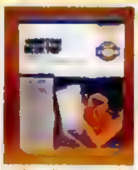


Run Windows six times faster than ordinary VGA! This 1mb VGA card features an ET4000 accelerator chip, maximum 1024x768 resolution, and standard 16 bit ISA compatibility. It also includes a Sierra RAMDAC chip which allows it to do 32,768 colors at the 800x600.

Norton Desktop for DOS $109



The Norton Desktop for DOS reduces learning time and frustration, and increases productivity for any DOS user. Launch programs from a menu. View, print, copy, backup and protect your data files easily, all without knowing a word of DOS! On line help is thorough and comprehensive and an easy-to-use quick reference card is included.

CTX SVGA 5468-NI $339

This 14" SuperVGA non-interlaced monitor provides resolutions up to 1024x768. It works with virtually all VGA cards and has scan rates up to 90 hz. Its .28 mm dot pitch and 800x600 make this monitor easy on the eyes. It supports up to 16.7 million colors and has an auto-swithing power supply from 90-260 volts.

Lotus SmartSuite for Windows $449

SmartSuite includes full-featured Lotus applications including 1-2-3 for Windows, Ami Pro for Windows, Freelance Graphics, and cc Mail. These leading edge applications in SmartSuite share more than just the Lotus name. They share innovations like SmartIcons for one-click access to the tasks you perform most. SmartSuite offers easy, consistent installation, menus, displays and help tools.

HARDWARE

CD & MULTIMEDIA

NEC CD Gallery $559

Get a whole CD set-up at one low price. Includes NEC CDR-37 Ext. CD player, a pair of amplified speakers, stereo headphones and XT/AT interface. Also includes Grolier Electronic Encyclopedia, Time Table of History, World Atlas, TIME Almanac, National Geographic Mammels, Great Cities of the World, and Battle Chess CD's.

CD-ROM Software
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- BattleChess or Carmen SanDeigo 45
- Berlitz Think & Talk French 99
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- Encyclopedia 69
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- MS Multimedia Beethoven 55
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- PC SIG Shareware CD 99
- U.S. or World Atlas - MPC Vers. 85
- World Atlas or U.S. Atlas 45

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The ultimate in video versatility for multimedia computing. Integrate video from a wide range of sources - video cameras, VCRs, TV - with your PC applications. Runs within Windows and lets you combine video with text & graphics.

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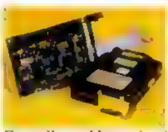
- NEC Ext. CD Gallery w/CDR37 559
- Pinnacle Internal CD-Rom w/Atlas 319
- Pinnacle External CD-Rom w/Atlas 379
- Soundblaster Pro w/ Int. CD Kit 559
- Sony Int. CD Drive Kit 349

ATI Stereo F/X 129

Creative Labs
- Multimedia Kit CD-ROM & SB Pro 559
- Sound Blaster 95
- Sound Blaster Pro (stereo & MIDI) 179
- Video Blaster 319

DRIVES

Seagate 130mb IDE Kit $339



IDE performance, big 130 megabyte capacity, 19ms access time and 5 mbps transfer rate make this a great buy. Controller, cables and rails are included to make installation fast and easy.

Colorado
- DJ-10 40-120mb Int. Tape 199
- DJ-20 80-240mb Int. Tape 259
- External Kit w/AB11 99

DTC
- 6280 ESDI 16bit HD/FD Cont 119
- 6280-15T 24mbit/sec transfer rate 169

Maxtor
- 7120A 120mb 15ms IDE 299
- 7213A 213mb 15ms IDE 499

Micropolis (see DTC Controllers)
- MC1664 345mb HH ESDI 14ms 899
- MC1568 668mb FH ESDI 14ms 1399
- MC1518 1.3gb FH ESDI 14ms 2399

Plus Development
- HardCard IIXL 50mb 9 ms 16bit 249
- HardCard IIXL 105mb 9 ms 16bit 399

Quantum
- LPS52A 52mb 9ms IDE 199
- LPS120A 120mb 9ms IDE 339
- LPS240A 240mb 9ms IDE 599

Teac 1.44mb 3.5" or 1.2mb 5.25" Floppy Drive $59

Genuine Teac quality at a low FastMicro price, these high density floppy drives also read, write & format low density floppy disks. They work great with all true 286, 386 & 486 compatibles. 1.44 mb 3.5" drive includes mounting kit and bracket. For rails for 1.2mb 5.25" drive, add $5.

DRIVES CONT.

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- 105MB ST3120A 19ms IDE Drive 279
- 125MB ST3144A 19ms IDE Drive 299
- 245MB ST3283A 12ms IDE Drive 549
- 425MB ST1480A 14ms IDE 999
- 1.3MB ST41600N 14ms SCSI 2299

Teac
- 1.2MB 5.25" Floppy 59
- 1.44MB 3.5" Floppy 59

Toshiba
- 360K 5.25" Floppy (Black) 59
- 1.2MB 5.25" Floppy 59
- 1.44MB 3.5" Floppy 59

Western Digital
- WDAC280 80mb IDE 20ms 259
- WDAC2120 120mb IDE 20ms 299
- WDAP4200 200mb IDE 20ms 479

MODEMS

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- 9600/E External MNP V.42bis 279

Everex 2400B Int Modem 65

Hayes
- Optima 9600 Ext. 349
- Optima 9600 Ext.w/ Fax 379
- Ultra 144 Ext. 669
- Pocket Edition 2400 Modem 119

Optima 9600 $349

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Practical Peripherals
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- PM9600SA Int. / Ext. ....279 /299
- PM14400FX Int. / Ext. ....379 /419

USRobotics
- 2400 Sportster MNP Int / Ext. ....149 /159
- 9600 Sportster Int / Ext. ....399 /449
- Courier HST 14,400 Int. / Ext. ....539 /559
- Courier HST 14,400 Dual Std Ext. 799

ZOOM
- 2400b Internal Modem 59
- 2400 V.42bis External Modem 119
- 9624 Send/Receive Int Fax Modem 79

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Whether you're a graphics or CAD user, the XLP is easy to use. Drivers include AutoDesk ADI and Windows 3.1 support. Bundle includes 4-button cursor, pen and lifetime warrantee. XLP-1218 available for $529.

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Logitech
- Mouseman Serial righthand 65
- Mouseman Bus righthand 65
- Mouseman Cordless 85
- PhotoMan 499
- ScanMan 32 139
- ScanMan 32 with Catchword 179
- ScanMan 256 for Windows 259
- Trackman 9/25 75

Microsoft
- Serial or Bus Mouse only 83
- Serial or Bus with paint 95
- Serial with Windows 147

NETWORKING

Artisoft/Lantastic
- Lantastic for Windows 165
- Lantastic 2 Station Ethernet Kit 469
- Ethernet Additional Stations 209

Eagle
- NE2000 2 Station NW Lite Kit 459
- NE1500 16 Bit 10baseT Adapter 149

FastData NE2000 16 Bit 10-BaseT 109

Intel EtherExpress 16 or 16TP 129

Novell Netware Lite 1.1 w/ DR DOS 65

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- Stealth VRAM HiColor 1mb 255

Everex EGA 480 Card 69

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- Diamond Scan 16L 919

NEC
- Multisync 3FGX 669
- Multisync 4FG 799
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- Farenheit 1280s HiColor 319

Panasonic C1381 VGA1024 329

Radius Color Pivot w/ Card 1099

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Sony 1304 Multiscan 599

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The Panasonic KX-P2123 combines high-quality 24 pin printing with 10 resident fonts and color upgradability at a great FastMicro price! It includes an easy to set front panel and prints up to 240 cps in draft mode. It is very quiet with only 46.5 dBA in standard mode and 43.5 dBA in Super Quiet mode. Plus, it has a two year warranty and you can upgrade to color for just $59.

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- FasMath387SX 75

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- RAM3000 16 bit - w/ 1mb 125
- RAM8000 16 bit - w/ 0K (max 8 mb) 169
- RAM8000 16 bit - w/ 2mb 269

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- 387-DX 85
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Memory - 1mb SIMMS 80ns 29

Memory - 1mb chips 80ns set of 9 39

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- BJ300 / BJ330 Ink Jet ....459 / 599
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- P3300 24 Pin Wide 339
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- Silentwriter 2 Model 95 1444

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PRINTERS CONT.

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- Okilaser 400 5

Panasonic
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- KXP1123 24 Pin 19
- KXP1124i High Speed 24 Pin 27
- KXP1624 24 Pin Wide 33
- KXP2180 Quiet 9 Pin 17
- KXP2123 Quiet 24 Pin 25
- KXP2124 Quiet 24 Pin C
- KXP21XX Series Color upgrade kit 5
- KXP2624 High Speed Quiet 24 Pin 3
- KXP4410/4430 Laser 649/C
- KXP4450i Laser 10
- KXP4455 Laser 16

QMS PS410 15

Seiko Smart Label Printer Plus 13

Star
- NX1001 13
- NX2410 / 2415 ....189 / 3

Texas Instruments
- Microlaser Plus PS17 11
- Microlaser Plus PS35 12
- Microlaser PS35 Turbo 15

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FastData Boards
- 16bit 1mb VGA 6
- 16bit 256K VGA 4
- 2400B Internal Modem 4
- 9600B Send/Rec. Fax w/2400B 6

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Resolution up to 1024x768 & 256 Colors, 16 bit interface and Trident VGA chip make the FastData 1m... SVGA card a great buy. Its compatib... with all standard compatibles ... VGA/SVGA monitors.

- CGA Card 3
- **Ethernet** 16bit 10Base-T 10
- **IDE** 16 Bit Hard/Floppy Disk Cont 2
- IDE HD/FD w/Par/2 Serial/Game 3
- MGP Card 2
- Parallel/2 Serial/Game Card 2
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FoxPro	449
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Paradox Competitive Upgrade	165
Paradox SE	65
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w Ventura Database Publisher	179

Smartcom Exec $69

Powerful communications software that combines terminal emulations, error-control protocols, and a text editor to meet the needs of virtually any user. In addition to modem sharing support over a LAN, Smartcom Exec provides SCOPE scripting language, keyboard macros, mouse control and more. It provides options for installation in one or more languages (English, French, Italian, Spanish or German) and multi-language documentation. SmartCom Exec also supports popular terminals emulations and error-control file transfer protocols.

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F-19 Stealth Fighter	38
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Aircraft & Scenery Designer	27
w Microsoft Golf	47
PC Globe or PC USA	35
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SimEarth	39
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Peachtree Accounting comes to Windows! It combines the easy to use graphical interface of Windows with powerful accounting features. This fully integrated system includes Gen Ledger, Accts Rec, Invoicing, Accts Payable, Payroll, Inv. and Job Costing. Writing checks is on screen easy and bank reconciliation is practically automatic. Plus its custom forms, report writer & data exchange really flex to your needs.

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ACCPAC Simply Accounting DOS	119
w ACCPAC Simply Acctg Windows	119
DAC Accounting 4.2	85
DAC Bonus Pack 4.2	119
DAC Accounting Upgrade	45
Managing Your Money	47
w Microsoft Money for Windows	45
Money Matters	29
w M Y O.B.	129
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w Peachtree Acctg. for Windows	69
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w RightWriter for Windows	55
WordPerfect 5.1	249
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w WordPerfect DOS to Win. Upgrade	79
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USER-TO-USER

Using EMM386 with DOS 5.0: A tiny program demonstrates that EMM386.EXE makes DOS 5.0 run in Virtual 86 mode.

BY NEIL J. RUBENKING

Using EMM386 with DOS 5.0

Have you installed DOS 5.0 to increase conventional memory on your 386 or 486, only to see your high-resolution video adapter's performance degrade as much as 50 percent? If so, you are not alone, nor is your copy of DOS 5.0 ridden with bugs. You may have found a largely undocumented feature of DOS 5.0: protected-mode overhead. To be precise, using EMM386.EXE causes DOS 5.0 to place the CPU in Virtual 86 mode.

Don't bother rushing to your copy of the *MS-DOS 5.0 User's Guide and Reference,* because you won't find any reference to VM8086 mode there. A bit of snooping, however, reveals some interesting information. The simple assembler program in Figure 1 checks the 32-bit control register 0 for the CPU mode and, if protection is enabled, checks for paging. Try executing the program with and without EMM386.EXE loaded in your CONFIG.SYS file. When you use EMM386.EXE, DOS places the CPU in protected mode with paging disabled. It makes no difference whether you request upper memory block (UMB) support, expanded memory (EMS) management, or both; DOS 5.0 switches the CPU to protected mode. But if you don't load EMM386.EXE, DOS leaves the CPU in real mode.

Why does DOS 5.0 switch to protected mode, and how can this cause performance degradation? First, most people use EMM386.EXE to provide UMBs in unused conventional-memory addresses between 640K and 1,024K. Mapping or *backfilling* these addresses from extended memory (memory above 1,024K) requires the CPU to operate in protected mode. DOS 5.0 uses HIMEM.SYS to access extended memory using the extended memory specification (XMS).

DOS 5.0 also offers a task switcher. Using the protection mechanisms of 386 or 486 CPUs, DOS can protect itself and user applications from memory updates and privileged instruction execution. EMM386.EXE causes DOS to place 386 and 486 CPUs into Virtual 86 mode, a subset of protected mode. (Virtual 86 mode is not available with 286 processors. So even though a 286 can address memory above 1,024K, it can't use EMM386.EXE to obtain UMBs.)

Virtual 86 mode allows a real-mode program to run in its own virtual machine. A Virtual 86 monitor intercepts interrupts and memory accesses and then decides whether to pass each request on to DOS in Virtual 86 mode or to emulate the request in full protected mode. OS/2 2.0, Windows 3.0, and Unix use this technique to allow concurrent DOS sessions.

As you can imagine, the trapping and state switching of the Virtual 86 monitor add to the number of instructions required to execute a real-mode program. For example, the new high-resolution video adapters provide their own device drivers, which may try to optimize display operation by writing directly to an I/O port or video memory locations. Such behavior triggers the Virtual 86 monitor. Overhead increases, and video performance decreases.

If, however, your video adapter contains a coprocessor, you may not experience the problem. Because the adapter CPU does most of the processing, there

VIRT8086.ASM

Complete Listing

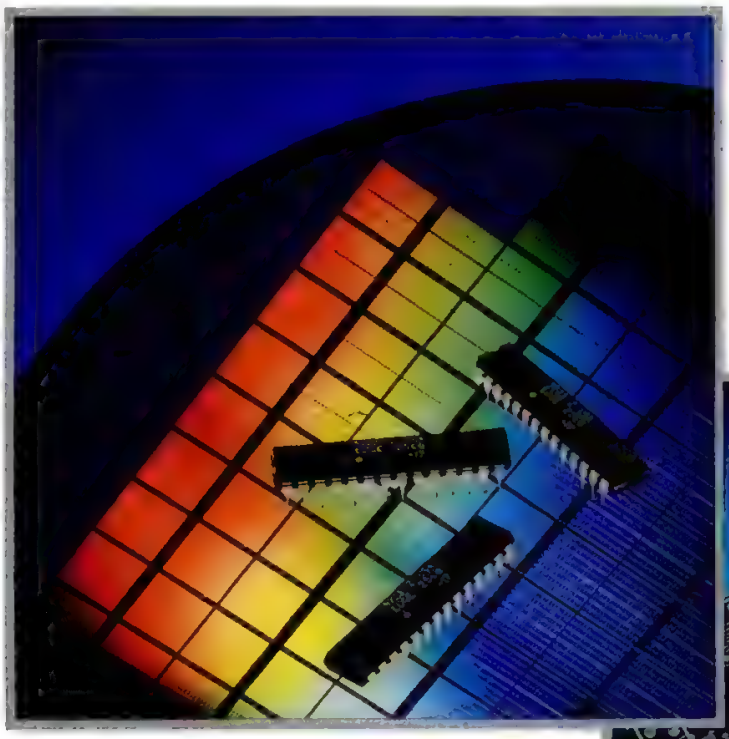
```
        DOSSEG
        .MODEL  SMALL
        .STACK  256
        .386P
        IDEAL

SEGMENT MYDATA  USE16 PARA 'DATA'
PROTNOPG DB     'CPU IS RUNNING IN PROTECTED MODE...PAGING DISABLED$'
PROTPG  DB      'CPU IS RUNNING IN PROTECTED MODE...PAGING ENABLED$'
REALMODE DB     'CPU IS RUNNING IN REAL MODE$'
ENDS    MYDATA

SEGMENT MYCODE  USE16 PARA 'CODE'
        ASSUME  CS:MYCODE               ;address code segment
TESTPROT:
        MOV     AX,MYDATA
        MOV     DS,AX
        ASSUME  DS:MYDATA               ;address data segment
        MOV     EAX,CR0                 ;get control register 0
        TEST    EAX,00000001H           ;If   Protection Enablement off
        JZ      GOTREAL                 ;Then CPU in Real Mode
        MOV     DX, OFFSET PROTNOPG
        TEST    EAX,80000000H           ;if   Paging Bit off
        JZ      WRITEIT                 ;Then only segment protection
        MOV     DX, OFFSET PROTPG       ;Else page level protection
        JMP     WRITEIT
GOTREAL:
        MOV     DX, OFFSET REALMODE
WRITEIT:
        MOV     AH,9                    ;Write mode status
        INT     21H
        MOV     AH,4CH                  ;Return to caller
        INT     21H
ENDS    MYCODE
        END     TESTPROT
```

Figure 1: **Run the VIRT8086 program under DOS 5.0 with EMM386.EXE loaded and you'll see that DOS 5.0 is running in protected mode.**

STEP UP TO THE EDGE...



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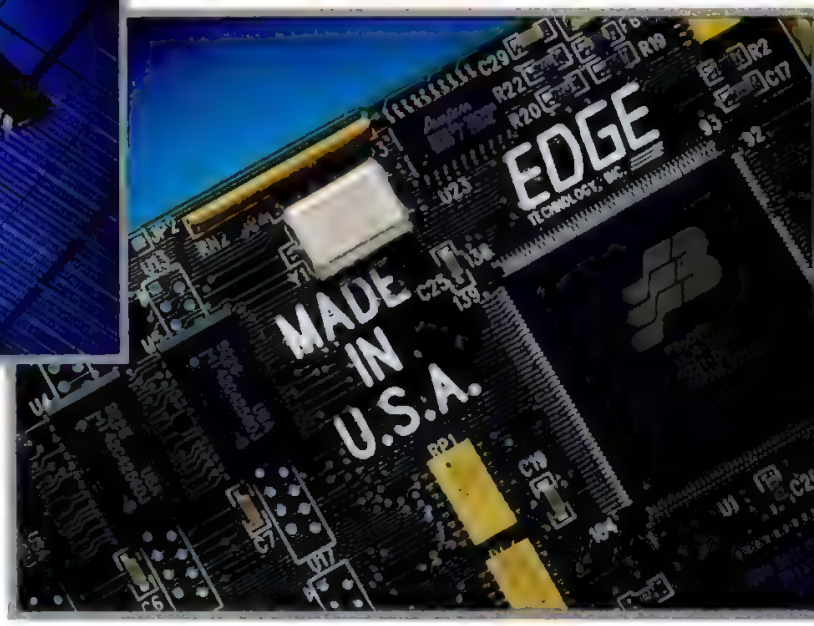

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VIRT8086.SCR

Complete Listing

```
NVIRT8086.BIN      ; The "E" and "F" lines below create the EXE header
E100 'MZ'
E102 B1 00 02 00 01 00 20 00 11 00
E10C FF FF 0C 00 00 01 00 00 00 00
E116 00 00 3E 00 00 00 01 00 FB 30
E120 6A 72
F122 13D 00
E13E 01
F13F 2FF 00
A300
MOV   AX,0003
MOV   DS,AX        ;next line is MOV EAX, CR0
DB    0F 20 C0
DB 66
TEST  AX,0001      ;with line above & below, TEST EAX, 00000001H
DB    00 00
JZ    325          ;jump to GotReal if protection disabled
NOP
NOP
MOV   DX,0000      ;offset of "protect w/ no paging" message
DB    66
TEST  AX,0000      ;with line above & below, TEST EAX, 00000000H
DB    00 00
JZ    328          ;jump to WriteIt if no paging
NOP
NOP
MOV   DX,0033      ;offset of "protect w/ paging" message
JMP   0328         ;jump to WriteIt
NOP
      ;next line is label GotReal
MOV   DX,0065      ;offset of "real mode" message
      ;next line is label WriteIt
MOV   AH,09        ; this is label WriteIt
INT   21
MOV   AH,4C
INT   21

E 330 'CPU IS RUNNING IN PROTECTED MODE...PAGING DISABLED$'
E 363 'CPU IS RUNNING IN PROTECTED MODE...PAGING ENABLED$'
E 395 'CPU IS RUNNING IN REAL MODE$'
RCX
2B1
W
Q
```

Figure 2: **This DEBUG script creates a file identical to that assembled from VIRT8086.ASM. You'll have to rename the resulting file to have an .EXE extension.**

is less Virtual 86 monitor overhead and less performance impact.

If you do experience degradation of video performance, it may be the Virtual 86 monitor overhead. Note that this can happen in any Virtual 86 environment, including those created by memory managers like QEMM and multitaskers like DESQview. But you may not have expected such behavior from vanilla DOS; Microsoft certainly doesn't advertise the VM8086 feature. Remember, you can still load DOS in the high memory area (HMA) without EMM386.EXE. So if the video degradation in native DOS is unacceptable, load DOS into the HMA, but remove EMM386.EXE from your CONFIG.SYS file. You may get your video speed back and still benefit from some of the DOS 5.0 memory relief.

Eric Webb
Research Triangle Park, North Carolina

▶PC MAGAZINE You won't necessarily notice a slowdown in your video performance with EMM386.EXE loaded. Still, it's interesting to know that your vanilla DOS 5.0 is probably running in Virtual 86 mode! Figure 2 shows a DEBUG script that will create VIRT8086.BIN. Feed the script to DEBUG with the command

```
DEBUG < VIRT8086.SCR >
 VIRT8086.LOG
```

Then check the .LOG file for any occurrences of the string `Error`. If there are no errors, rename the resulting file to VIRT8086.EXE.

If you run the program with QEMM-386 loaded, you'll get the message that indicates protected mode with paging enabled. QEMM supports DESQview, and on a 386 each DESQview window is a separate Virtual 86 machine. When there's more than one Virtual 86 mode process in existence, paging *must* be enabled. This can't happen with DOS 5.0's own DOSSHELL, though. It's a task switcher, not a multitasker, and never requires more than one virtual machine, as you can see by running VIRT8086.EXE under the task switcher. (You can download all VIRT8086 files from PC MagNet, archived as VIRT80.ZIP.)

Taking Out the Trash

The drag-and-drop feature in Windows 3.1 lets you do lots of fun and silly things, like inserting sound icons in Write documents. It also lets you use the much improved File Manager to create a Macintosh-like trash can capability (without, alas, the garbage can icon).

Start by opening the File Manager and creating a new directory—let's say C:\TRASHCAN. Double-click on the new directory to open a window showing its contents, then minimize that window. Adjust your open windows so you can see the minimized icon named C:\TRASHCAN at the bottom of the File Manager window.

Now you can use File Manager's drag-and-drop capability to move files and even whole subdirectories into the trashcan. If you highlight a file or group of files on the same drive as the TRASHCAN directory, you can move them by simply dragging them. If the selected files are on a different drive, press the Alt key while dragging the mouse. Dragging without Alt will simply copy the files.

Emptying the trash is more complex. In the File Manager, you can open the TRASHCAN directory, select all the contents, and press Del. Depending on what you've chosen in the Options | Confirmation menu, you may be prompted to approve of deletions or subtree deletions.

You could also add a line like

```
ECHO Y | DEL C:\TRASHCAN\*.*
```

in your AUTOEXEC.BAT file to empty the trash whenever you boot up, though of course this won't delete files in subdirectories that have been moved into the trash. Despite this minor inconvenience, File Manager provides quick-and-dirty trash can capabilities, without the fear of a look-and-feel lawsuit.

Alan Zisman
Vancouver, BC, Canada

▶PC MAGAZINE Dragging unwanted files into a trash can directory is certainly safer than deleting them outright. Until you empty the trash, "undeleting" a file is as simple as moving it out of the trash can and back to its original directory. And as long as you've checked the "Save settings on exit" option, the minimized C:\TRASHCAN directory will appear every

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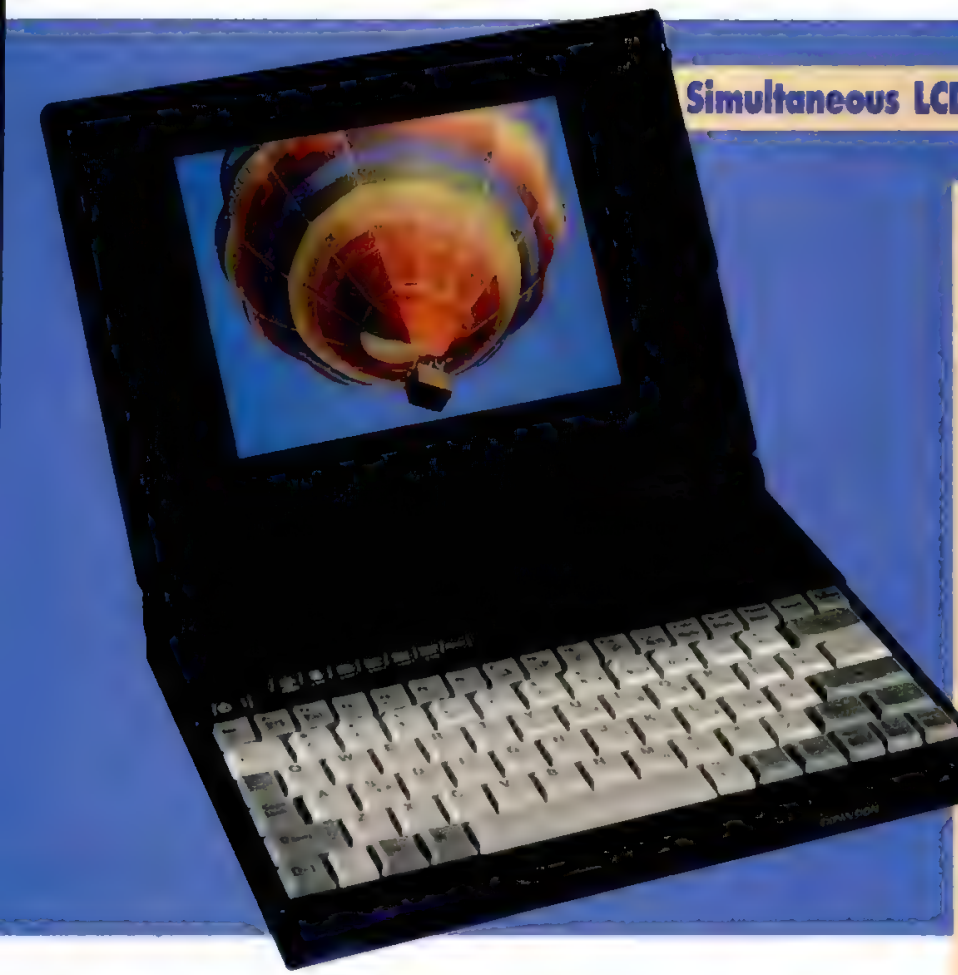

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TRASHOUT.BAT

Complete Listing

```
@ECHO OFF
REM ---------------------------------
REM TRASHOUT.BAT - empties C:\TRASHCAN
REM Requires DOS 5.0
REM ---------------------------------
IF NOT '%1'=='' GOTO OneDir
REM Modify the next lines so they switch to the drive
REM and directory that YOU use for batch files.
C:
CD \BAT
REM Fill DIRLIST.DAT with a list of all directories
REM under C:\TRASHCAN, in reverse sorted order
DIR C:\TRASHCAN /A:D /B /S /-L | SORT /R > DIRLIST.DAT
:===== Loop ==========
  COPY TRASHOUT.DAT + DIRLIST.DAT TRASHTMP.BAT > NUL
  CALL TRASHTMP
  TYPE TRASHTMP.BAT | FIND /V "trashout" > DIRLIST.DAT
  COPY DIRLIST.DAT ANYLEFT.DAT > NUL
  IF NOT EXIST ANYLEFT.DAT GOTO OutOfLoop
  DEL ANYLEFT.DAT
  GOTO Loop
:===== OutOfLoop =====
DEL DIRLIST.DAT
DEL TRASHTMP.BAT
ECHO Now emptying the TRASHCAN
ATTRIB -R C:\TRASHCAN\*.* /S
IF NOT EXIST C:\TRASHCAN\*.* GOTO CanEmpty
ECHO Y | DEL C:\TRASHCAN\*.* > NUL
: CanEmpty
GOTO Done
:===== OneDir ========
ECHO Wiping out directory %1
IF NOT EXIST %1\*.* GOTO DirEmpty
ECHO Y | DEL %1\*.* > NUL
: DirEmpty
RD %1
:===== Done ==========
```

Figure 3: **This batch file deletes all files and directories in or below the directory C:\TRASHCAN.**

time you open the File Manager.

The problem, as Mr. Zisman notes, lies in taking out the trash. You can delete the files and directories individually within the File Manager, but it's not easy to automate the process. I wrote the DOS 5.0 batch file TRASHOUT.BAT, shown in Figure 3, to empty the trash can directory and all of its subdirectories automatically. (You can find TRASHOUT on PC MagNet, archived as TRASH.BAT.)

TRASHOUT is a double-duty batch file: It creates a list of directories in and below the trash can directory and then recursively calls itself, passing each directory on the list as a command line parameter. The IF test near the beginning distinguishes the initial run of TRASHOUT (with no parameters) from the recursive calls. If there are no parameters, the program starts by switching to the C: drive and the \BAT directory. Naturally, if you store your batch files in a different drive or directory, you'll need to change these two lines.

The DIR command just before the label Loop uses a number of DOS 5.0–specific switches; /A:D selects directories only, /B requests a bare listing (full pathname only), and /S says the DIR listing should extend into subdirectories. The /-L switch ensures that DIR does not report its results in lowercase; we'll see below why that's necessary. The output of DIR is piped through the SORT filter, and the /R switch tells SORT to put the list of names in reverse order. Finally, the sorted result is redirected into DIRLIST.DAT. Sorting the list of directories first is necessary to prevent the batch file from attempting to remove a directory that still contains subdirectories. Because TRASHOUT.BAT processes the directories in reverse order, subdirectories will always be processed before the directory that contains them.

The lines from the label Loop to the GOTO Loop line process each directory in turn. TRASHOUT.BAT depends heavily on a simple 9-byte file called TRASHOUT.DAT, which must reside in the batch directory. To create it, enter the command COPY CON TRASHOUT.DAT, then type "trashout"(in small letters) followed by a space. Press Ctrl-Z and Enter to save the file.

Each time through the loop, TRASHOUT.BAT processes the first directory on the list and then removes that directory from the list. To start, it concatenates TRASHOUT.DAT with DIRLIST.DAT and stores the result in TRASHTMP.BAT. The first line of TRASHTMP.BAT has the form

```
trashout C:\TRASHCAN\FOO
```

When the main batch file CALLs this temporary batch file, only that first line gets executed, calling TRASHOUT.BAT again, this time with a command line parameter so the initial IF test jumps to the label OneDir. Batch lines at this label announce which directory is being deleted, then delete the files in that directory and remove the directory.

After the recursive call, TRASHOUT.BAT uses the FIND filter to select all lines from TRASHTMP.BAT except the one that contains the string "trashout", then redirects the result back into DIRLIST.DAT. Since the directory listing is all uppercase and FIND is case-sensitive, only the first line of the batch file gets filtered out.

When the last directory has been processed, DIRLIST.DAT winds up empty. The COPY command refuses to copy an empty file; TRASHOUT.BAT uses this fact to test whether the directory list still exists. If it does, the file ANYLEFT.BAT also exists. TRASHOUT.BAT deletes it and jumps back to the label Loop. If the directory list no longer exists, TRASHOUT.BAT jumps out of the loop, to the label OutOfLoop. TRASHOUT's cleanup occurs at the label OutOfLoop. It deletes the empty DIRLIST.DAT file and the now-useless TRASHTMP.BAT. Then it wipes out any files in the trash can directory itself. Whew! The trash has been emptied.

You can put the line CALL TRASHOUT.BAT in your AUTOEXEC.BAT file if you want to empty the trash each time your computer boots up. My choice, though, is to add TRASHOUT.BAT to my Main group in the Program Manager and assign it an appropriate icon. Now I can take out the trash just by double-clicking on that icon! □

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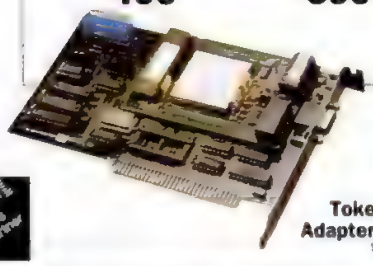

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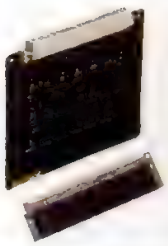

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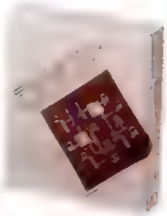

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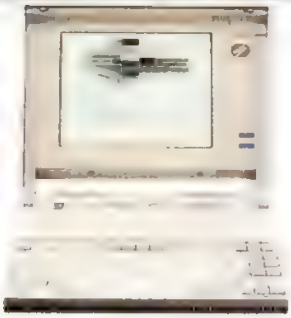

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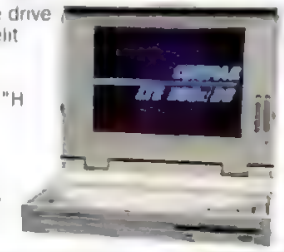

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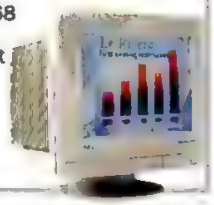

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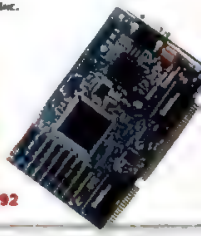

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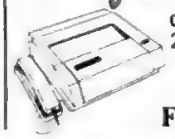

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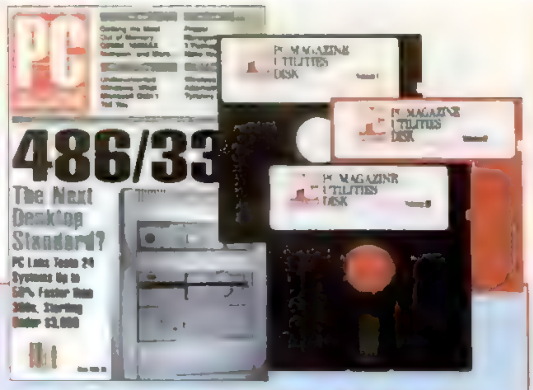

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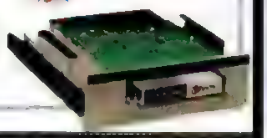

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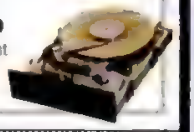

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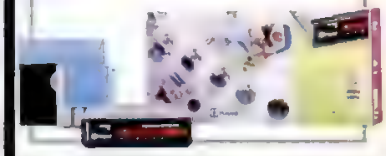

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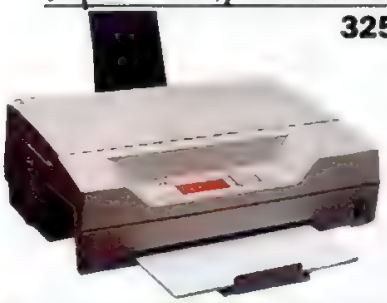

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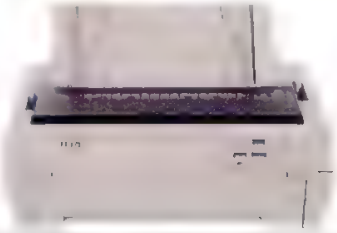

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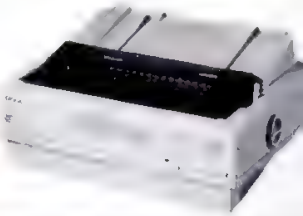
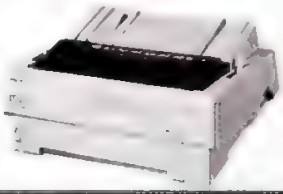
24-pin, narrow carr., 360 dp
225* cps, 105-LQ, 12 fonts



LQ-870
$429
24-pin, narrow carr., 360 dpi, 300* cps, 138-LQ, 12 fonts



LQ-860 Color
$554
24-pin, narrow carr., 360 dpi, 300* cps, 98-LQ, 4 fonts

LQ-1170
$589
24-pin, wide carr., 360 dpi, 300* cps, 138-LQ, 12 fonts

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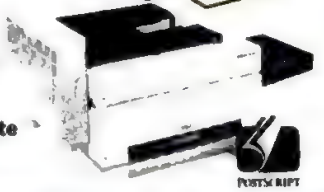
High performance RISC processor speeds processing time up to 6 times faster than conventional PostScript Printers

Special Low Price Limited Quantity

- **Up to 8PPM**
- 35 Scalable Adobe® fonts, 14 HP bitmapped fonts
- 300 x 300 DPI
- 2 MB exp. to 4 MB
- 200 sheet letter cassette
- **First 90 days on-site service by NEC**

B1-SW990



NEC Silentwriter Model 95fx $1849

NEC's NEW model 95 PostScript® laser printer with built-in plain paper send/receive fax capability... the perfect solution for small businesses.

NEW

- **Up to 6PPM**
- Automatic interface switching and exceptional paper handling
- 35 Scalable Adobe fonts, 14 HP bitmapped fonts
- 300 x 300 DPI
- 2 MB exp. to 5 MB
- 250 sheet letter cassette/env. feeder

B1-NEC95FX

Panasonic

KX-P4410 LaserPartner Printer

5 ppm, 28 fonts, 300 dpi, 512K, 1-200 sht. paper cassette, 1 font card slot

$619

KX-P2180

9-pin narrow carr. 240 X 216 dpi 240 cps 38-NLQ 9 fonts

COLOR OPTION **$169**

KX-P2123

24-pin narrow carr. 360 dpi 240 cps 80-LQ 10 fonts

COLOR OPTION **$239**

KX-P2124

24-pin narrow carr 360 dpi 320 cps 106-LQ 12 fonts

COLOR **$299**

KX-P2624

24-pin wide carr. 360 dpi 300 cps 100-LQ 11 fonts

$359

SAMSUNG

Finale™ 8000 Laser Printer

$1349

NEW

B1-FB000
LIST PRICE $1995

POSTSCRIPT

Processes data 5 to 6 times faster than most other printers

- 8 pages per minute • 6 resident emulations
- 300 dpi upgradeable to 600 dpi
- Windows 3.1 compatible • Dual paper trays
- Intel i960i™ 16 MHz 32-bit RISC processor
- 35 PostScript® compatible typefaces, 14 bit-mapped fonts and 8 scalable fonts
- Samsung Auto Interface Switching™ automaticlly switches between interfaces
- 2 MB of RAM, expandable to 18 MB
- 2 year warranty and toll-free support hotline

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7 Color Printing

NX-1020 RAINBOW

$179

- 9-Pin
- 10 Resident Fonts
- Up to 225 cps in Draft mode

B1-NX1020R

NX-2420 RAINBOW

- 24-Pin
- 7 Resident Fonts
- Up to 250 cps in Draft mode

B1-NX2420R

$299

NX-2430 MULTI-FONT DOT MATRIX PRINTER

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- 24-Pin
- 11 Resident and 13 Scalable Fonts
- Up to 240 cps in Draft mode

B1-NX2430

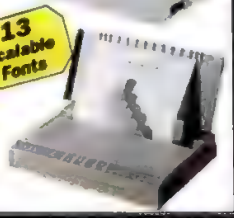
STARJET SJ-48 INK JET PRINTER

13 Scalable Fonts

$295

- 64 Nozzles
- 4 Resident and 13 Scalable Fonts
- Up to 166 cps in NLQ mode

B1-SJ-48



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NEC, PANASONIC SAMSUNG & STAR MICRONICS PRINTERS

NEC 24-Pin Pinwriter® Dot Matrix Printers with 360 DPI

P3200 Narrow Carriage, 8K buffer, up to 216 CPS **$229**
P3300 Wide Carriage, 8K buffer, up to 216 CPS **$329**
P6200 Narrow Carriage, 80K buffer, up to 300 CPS **$409**
P6300 Wide Carriage, 80K buffer, up to 300 CPS **$629**
P9300 Wide Carriage, 80K buffer, up to 400 CPS **$829**

Additional NEC Silentwriter Printers

Silentwriter Model 95 - PostScript ®, 6PPM, 35 scalable Adobe fonts, 14 bitmapped and 8 scalable fonts, 300 DPI, 2 MB exp. to 5 MB, 250 sheet letter cassette, envelope feeder *B1-NEC95* **$1399**

NEC Color Printer

Colormate PS™ Model 40 - PostScript ®, 300 DPI thermal transfer technology, 1 PPM/color and 3 PPM/mono *B1-CMPS-40* **$4299**

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KX-P4430 - 5 ppm, 28/8* fonts, 300 dpi, 1MB, 1 200 sht. paper cassette **$859**
KX-P4450i - 11 ppm, 28 fonts, 300 dpi, 512K, 2 250 sht. paper cassette **$1049**
KX-P4455 PS - PostScript, 11 ppm, 39 fonts, **300 dpi**, 512K, 2 250 sht. paper cassette **$1669**
*24 bit 8 scalable fonts plus Panasonic Satin Print Technology

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KX-P1124i 24-pin, narr. carr., 360 dpi, 300 cps, 100 NLQ, 11 fonts **$269**
KX-P1624 24 pin, wide carr., 360 dpi, 192 cps, 63 LQ, 7 fonts **$329**
KX-P1695 9 pin, wide carr., 240 X 216 dpi, 330 cps, 66 NLQ, 8 fonts **$349**
KX-P1654 24 pin, wide carr., 360 dpi, 375 cps, 125 NLQ, 10 fonts **$529**

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PostScript Premium (39 fonts)** *1424039* $609

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Scalable font Card (22 additional fonts)** *1183336* $279
PostScript Option** *1183340* $349
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DOT MATRIX PRINTERS

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Additional 22 Scalable Fonts Card
Additional 4 MB of Memory
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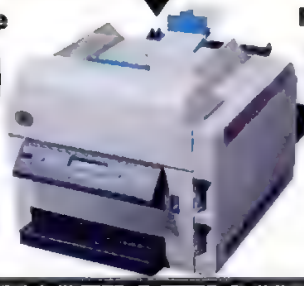

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IBM Color Jetprinter PS 4079 PostScript Color Printer

Thermal Inkjet Postscript printer, true 4-Color Process (C,M,Y,K), 360 dpi, AMD 16MHz full 32-bit RISC processor, 35 scalable type 1 fonts, parallel, serial, and AppleTalk interfaces, 1 year on-site warranty, 4MB memory
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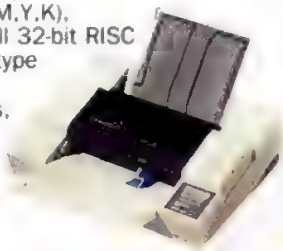

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5 PPM upgradable to 10 PPM, 10 Fonts, 512K exp. to 4MB, 300 dpi, optional PostScript software available **$749**

IBM LaserPrinter (4019001)
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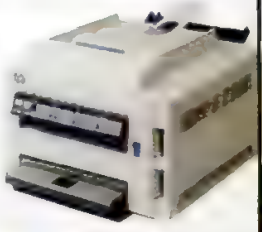

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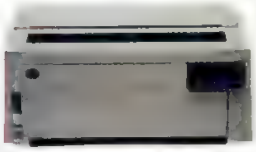
- 1 Year Onsite IBM warranty



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24-pin
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200 cps
60-LQ
8 Fonts

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- 4 lbs without sheet feeder and 7 lbs. with
- Easy to use six-button control panel
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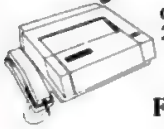

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LZR 965 Adobe PostScript Level 2, HP PCL 4 Laser Printer

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- 300 or 400 dpi resolution
- PostScript Level 2 from Adobe
- Max 15 PPM • 4MB Memory
- 35 resident typefaces

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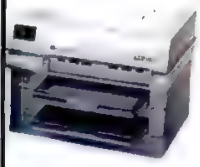

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- HP PCL® 5, GL/2, HPGL® Language
- Max 15 PPM • 4MB Memory
- 13 Scalable and 14 bitmap fonts

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- 33-pin printhead
- Up to 750 LPM • 6 resident fonts
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Aisle 16 Dataproducts® Printers

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LZR 1555 4MB Memory	$439
EP Cartridge Kit	$249
Fuser Kit	$179

LZR 960 & LZR 965

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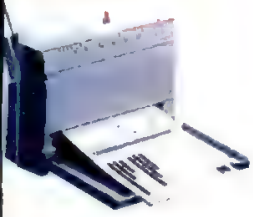
LX 455

Pedestal with paper stacking shelf	$399

Canon

Canon BJ-10ex $299

Up to 360 dpi resolution, 37 KB buffer, 6 fonts, IBM & Epson emulation, Prints up to 142 cps (17 cpi), Handles plain paper and transparencies.



Pictured: Canon BJ-20

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With Detachable Automatic 50-Sheet Feeder - Up to 188 cps (17 cpi), IBM Proprinter® X24E, Canon, BJ-130e and Epson® LQ-510 emulation, easy to use control panel, 360 dpi resolution, laser-quality precision.

Canon BJ-300 ..... $429

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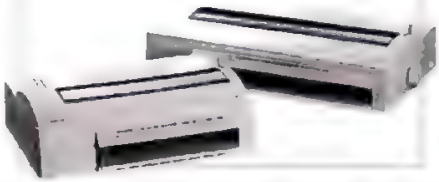

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Canon

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Canon BJ-800 ..... $2199

Canon BJ-820 ..... $2399

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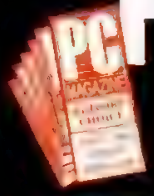

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CIRCLE 045 ON READER SERVICE CARD

CONNECTIVITY

Speedier Printing: How to get large jobs to print quickly on a network.

BY FRANK J. DERFLER, JR.

Speedier Printing

We have three workstations connected to a file server running NetWare 2.2. Often, we run very large print jobs. We could save hours if jobs could be printed as soon as the first page was ready. But NetWare won't send anything to the printer until the entire job has been collected in the spooler. Is there any way to move jobs to the printer immediately?

Donald Mallison
Washington, Illinois

▶**PC MAGAZINE** Your application sounds like the type that feeds out print jobs one page at a time instead of forming a complete print image and sending the entire job to the printer in a single shot.

As you note, NetWare only moves a job to the printer when the print queue closes, which occurs if the application itself closes or if it sends no new data before an optional time-out indicator reaches its limit (which you can adjust).

I posed your question to people at the major makers of NetWare add-ons. The consensus was best stated by this comment from one of the representatives: "In order for any print server to service a spooling job, Novell would have to allow developers to add extensions to the Queue Management System. Right now, I don't know of any such plans."

Artisoft's LANtastic does have the immediate de-spooling capability you need and would carry your workload. The product gives you a "virtual session" with the printer in order to avoid intermixing of pages from different jobs. Presumably, though, you'd rather not replace what you have. In this case, an A-B switch box is the simplest trick. Run the server's printer cable to one input of the switch box, instead of directly to the printer. Route another printer cable from the client PC (on which you create the print job) to the box's other input. For long print jobs, select the PC's local port in software and switch the A-B box so that the machine connects directly to the printer and is disconnected from the server. In this configuration, the NetWare queue will hold jobs, believing the printer to be in a not-ready state.

Printer sharing through a device like the ServerJet from ASP Computer Products (408-746-2965) offers another alternative. This and similar products deal out printer access to applications on a first-come-first-served basis while storing other incoming jobs in their internal RAM. To implement this solution, a printer cable must connect each workstation to the sharing device. Once again, you bypass the network's printing services. Your report would print each page, one at a time, as the PC prepares it.

Read the next letter for more information about printing under NetWare.

Printing Under NetWare

In your column of December 31, 1991, you replied to a letter concerning slow printing of graphics jobs over NetWare. Novell gives you the option of using a time-out parameter in the capture command with the statement TI=x, where x is the time limit in seconds. Setting this to a relatively short interval (say 5 or 10 seconds) closes the queue if it receives no data within the alloted time. Wouldn't this speed graphics printing?

Richard Fowler
Carson, California

▶**PC MAGAZINE** Setting a short time-out interval might speed some jobs, but not necessarily. In fact, you have to be careful when adjusting the print spooler time-out on a network. Understanding the potential problems requires some background information about network printing.

Most such schemes demand that an entire print job be collected by the spooler before being released to the queue—with good reason. On a network, many other print jobs may hit the server before the current one has finished. In the absence of any governing method, output from the various sources would mix in a hopeless jumble. To avoid this, the network demands that each job finish before entering the queue. But how can the network know when an application has no more data to send?

Some programs are network-aware and send an end-of-job (EOJ) indicator to the particular network operating system (NOS). Otherwise, the NOS can only guess—which it does one of two ways. If DOS informs it that the application has closed, the NOS assumes that printing must be over. Alternatively, if the spooler receives no data before the end of a (generally adjustable) time-out period, the job is closed. But trouble can occur because of the varying ways in which applications handle printing.

Some programs send everything in one shot, while others parcel out their printing, often thinking for a considerable time in between data transmissions. And this can wreak havoc with time-out parameters. Setting too short a time-out might cause the spooler to close before a job finishes, allowing others to sneak in before the original's next parcel and resulting in mixed output. Too long a time-out will cause printing from applications that send all data in one big bundle to wait an unnecessarily long time before passing to the queue.

Note that whether fiddling with the time-out parameter speeds printing at all depends on the method that applications employ to send print data, and on the fre-

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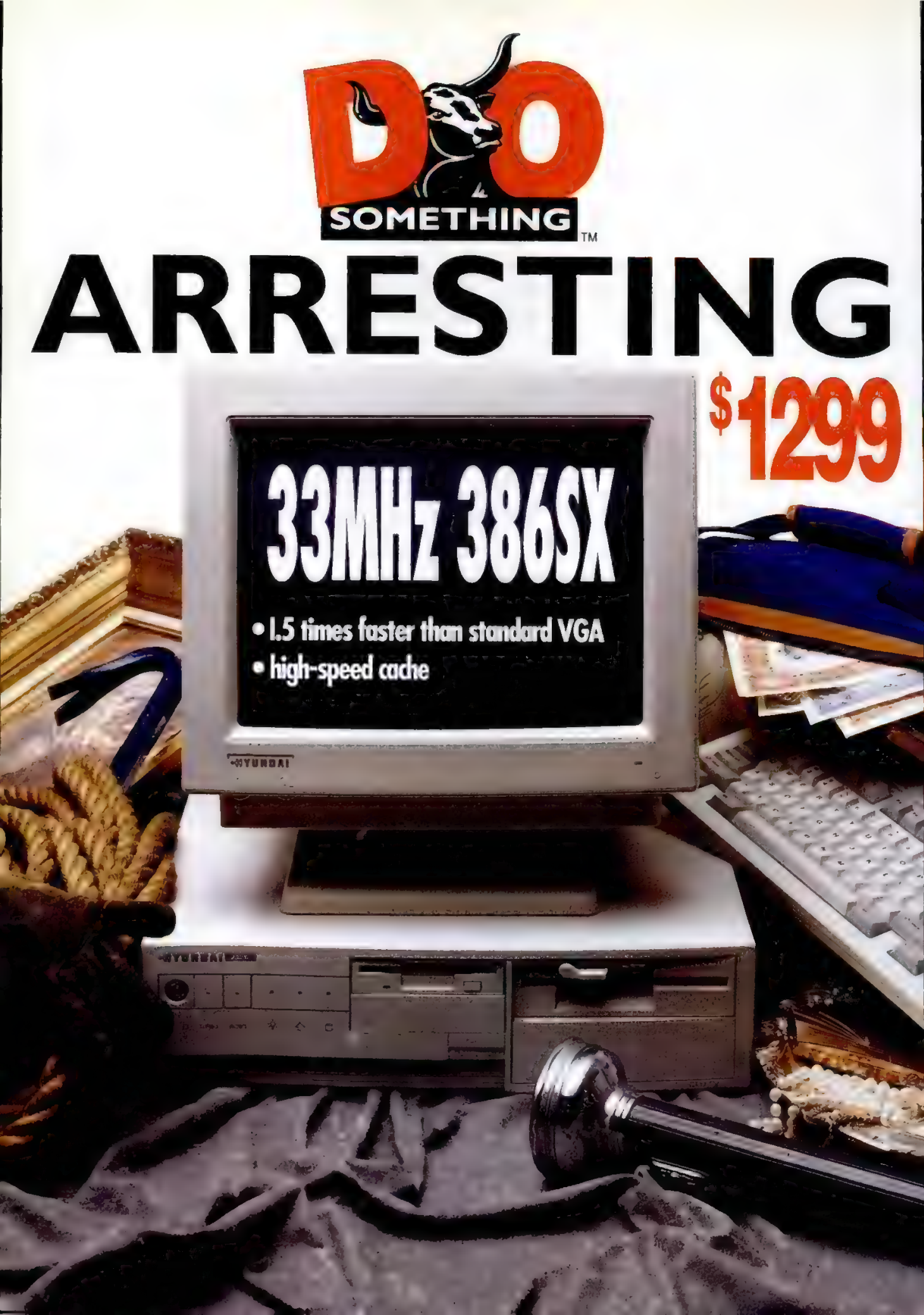
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CIRCLE 275 ON READER SERVICE CARD

quency with which applications using one method or another print. Experiment with settings of the TI parameter to make sure you don't get pages from different jobs interleaved.

Linking a PC with a Laptop

What is the best way to access files on a laptop from my desktop PC, which is connected to a NetWare 3.11 network over Token-Ring? I also want to access the network from the laptop and move files between the two machines.

Bill Henry
New York, New York

▶**PC MAGAZINE** There are two good options: using NetWare alone, and using it together with LANtastic. First consider putting the laptop on the NetWare LAN. In the January 14, 1992, issue we reviewed several external Token-Ring adapters that will work with your laptop. You can slap an adapter on the back of the laptop, run a batch file, and connect the laptop to the Novell server. This configuration gives you full access to all networked resources, but you'll need to move files through the server since you won't have direct access between the desktop and the laptop computers.

The practicality of this configuration depends on how much you use the server to store your working files. If you need to exchange files between the laptop and the desktop PCs without going through the server, you can run LANtastic over NetWare. In this configuration, you run Novell's IPX and NET*x* on both the desktop PC and the laptop. The laptop uses an external LAN adapter hooked to the Token-Ring wiring center. Then you run Novell's NetBIOS interface over IPX in both machines. An Artisoft product called LANtastic for NetWare runs over the Novell NetBIOS emulator in both machines.

After you load all these programs, your desktop PC retains its ability to be a client on the NetWare network while becoming a server to the laptop. The laptop is a client on the NetWare server, and it is a client to the new LANtastic server software running on your desktop machine. If you prefer, your laptop can also be a server to the desktop PC.

You'll need two LAN cable runs from your office to the wiring hub. If you don't have two runs installed, you can use a two-port hub in your office. The Black Box catalog (412-746-5530) lists one for $225 that links both computers to the central Token-Ring wiring hub over the single wiring run from the office.

Although it sounds complex, the LANtastic for NetWare system works well. It will give you good peer-to-peer flexibility with high reliability at the same time. □

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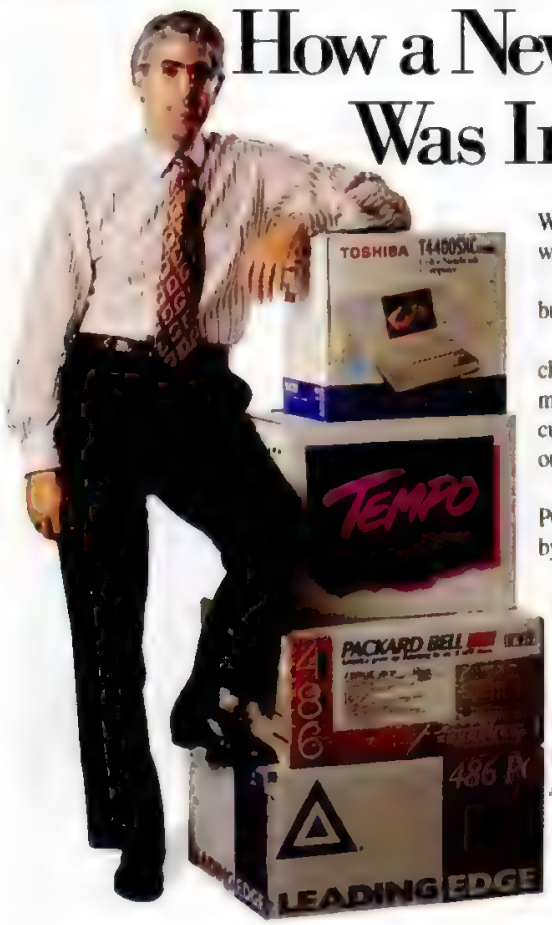

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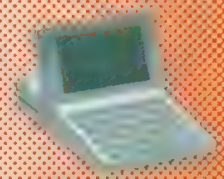

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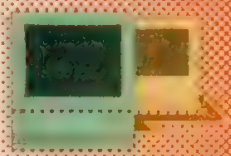

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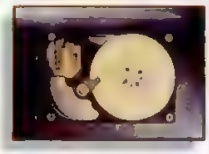

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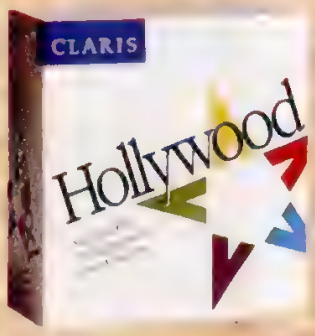

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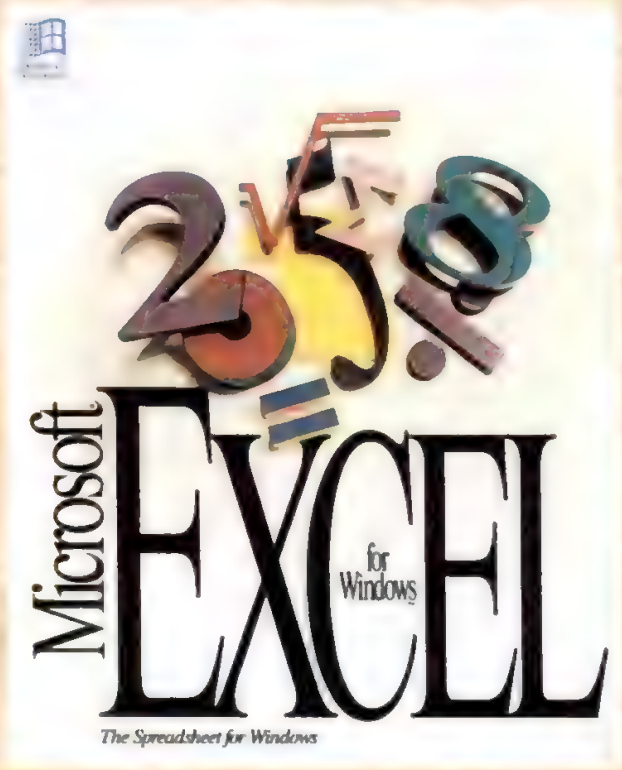

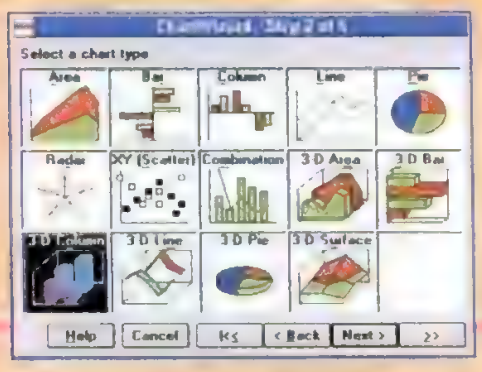

- ▲ The Toolbar gives you one-step access to the most frequently used commands. To call up optional toolbars, such as drawing or charting, click with the right mouse button anywhere on the main toolbar. It's easy to create your own custom tools and toolbars.
- ▲ The Utility toolbar is just one of the seven task-oriented toolbars that comes with Microsoft Excel 4.0. This toolbar makes checking your spelling, adding text boxes, zooming and more simple, one-step processes.
- ▲ Automatic alignment tools let you realign entries with a single click on the Toolbar.
- ▲ File Management tools let you open a new worksheet, find an old one, save an existing file (any format), or print, with just one click on the Toolbar.
- ▲ CrosstabWizard lets you easily create summary tables from databases. If you want to run a report about sales revenue by region, product and month. Call up the CrosstabWizard, fill in the values and fields that you want in your report, and in seconds, Microsoft Excel creates the summary table you want. Click the AutoFormat button and you've got a beautiful custom report.
- ▲ Use the ChartWizard to create 3-D graphs or charts from the information in the Scenario Manager.
- ▲ Scenario Manager helps you create and save multiple "what if" scenarios. Just fill in the variables in the dialog box, and Excel does the rest
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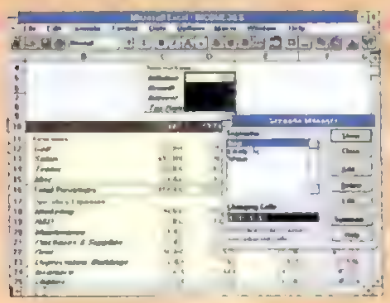

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11335	ManagePro 1.0	248	W
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11257	Quattro Pro for Windows	328	W
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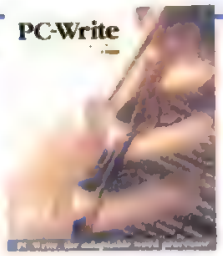

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CIRCLE 131 ON READER SERVICE CARD

SPREADSHEETS

Excel Batch Printing: An Excel macro that lets you specify ranges of pages to print. **Sequential References:** Insert a series of linked worksheet filenames.

BY CRAIG STINSON

Excel Batch Printing

I often work with large Excel spreadsheets that span many pages. Printing a file of this kind can be quite time-consuming. Much of the time I don't need all of the pages, and it's a waste of paper to print all of them. But in order to print nonconsecutive pages, each page must be printed separately, which takes even more time, more keying, and more mouse clicking.

The macro shown in Figure 1 solves this problem. It allows you to print individual pages, ranges of pages, multiple pages, or multiple ranges in any order, all with one command. For example, to print pages 1, 3, 24 to 26, 9, 13, and 6 to 10, simply enter "1,3,24-26,9,13,6-10" into the pop-up box.

The macro starts when the user selects Print | Page Range from the File menu or presses Ctrl-Shift-R. The macro contains simple error handling for bad page ranges. The Print | Page Range option is added to the File menu when you open the macro sheet and restored when you close it.

Dale Arndt
Weston, Ontario
Canada

▶**PC MAGAZINE** Mr. Arndt's macro provides a valuable addition to Excel's printing capabilities. You could use the Report Manager add-in in Excel 4.0 to print separate worksheet blocks with a single command, but it's not terribly convenient to use. (To define a report with the Report Manager, you first have to load another add-in, called the Views Manager. Then you can specify various combinations of print settings as named views. After doing that, you would invoke the Report Manager and define a report as a collection of previously named views.) If all you're interested in doing is printing a few select pages, using Mr. Arndt's Print Range macro is a lot simpler.

When entering this macro, be sure to define the following names:

Auto_Open =$A$1
Auto_Close =$A$5
PrintStart =$A$10
PrintError =$A$39
PrintMenuName =$A$57
PrintMenu =$A$57:$B$57
PageFrom =$B$48
PageTo =$B$50
TempStr =$B$52
PageStr =$B$54

In addition, if you want to be able to invoke the PrintRange macro with a keyboard shortcut, be sure to specify in the Define Name dialog box that PrintStart is a command macro and tell Excel what shortcut you want to use. (The macro that's printed here and available on-line defaults to a hotkey of Ctrl-Shift-R.)

The comments that appear in column B make the macro's logic almost self-explanatory. One component that might not be completely obvious is the =ERROR(FALSE) in cell A21. Without this line, if the user enters an invalid page print string in the dialog box, the SEARCH function in line 22 returns a #VALUE! error, and the macro comes

PRNRNG.XLM

1 of 2

	A	B
1	Auto_Open	Executed on sheet open
2	=ADD.COMMAND(1,"File",PrintMenu, GET.BAR(1,"File","Print Preview"))	Add command to "File" when opened
3	=RETURN()	Stop macro
4		
5	Auto_Close	Executed on sheet close
6	=ERROR(FALSE)	
7	=DELETE.COMMAND(1,"File",PrintMenuName)	Remove command from "File" when closed
8	=RETURN()	Stop macro
9		
10	PrintStart	Executed on menu click
11	=SET.VALUE(PageStr,INPUT("Enter the pages to print. (e.g 1,2,3-6,12-17,8,19)",2,"Selective Page Print",PageStr))	get user input
12	=IF(PageStr=FALSE)	if user cancelled
13	= RETURN()	then stop macro
14	=END.IF()	
15	=WHILE(LEN(PageStr)>0)	As long as PageStr is not empty,
16	= IF(ISERROR(SEARCH(",",PageStr,1)-1))	If there's no comma in PageStr,
17	= SET.VALUE(TempStr,PageStr)	Assign PageStr to TempStr.
18	= ELSE()	Otherwise,
19	= SET.VALUE(TempStr,LEFT(PageStr, (SEARCH(",",PageStr,1)-1)))	Assign to TempStr everything in PageStr up to character before first comma.
20	= END.IF()	
21	= ERROR(FALSE)	
22	= IF(SEARCH("-",TempStr,1))	If TempStr includes a hyphen,

***Figure 1:* This Excel macro will let you enter page numbers and ranges of pages so you can print them all in one operation. Note that the INPUT function in A11 obviates the need for a dialog box definition range.**

PRNRNG.XLM

2 of 2

23	= SET.VALUE(PageFrom,LEFT(TempStr,(SEARCH("-",PageStr,1)-1)))	Assign to PageFrom everything in TempStr up to character before hyphen.
24	= SET.VALUE(PageTo,RIGHT(TempStr,(SEARCH("-",PageStr,1)-1)))	And assign to PageTo everything in TempStr following the hyphen.
25	= ELSE()	Otherwise,
26	= SET.VALUE(PageFrom,TempStr)	Assign TempStr to PageFrom.
27	= SET.VALUE(PageTo,TempStr)	And also assign TempStr to PageTo
28	= END.IF()	
29	= ERROR(TRUE,PrintError)	Direct error handling to PrintError.
30	= PRINT(2,PageFrom,PageTo)	Print from PageFrom to PageTo.
31	= IF(ISERROR(SEARCH(",",PageStr,1)-1))	If PageStr is now comma-less,
32	= SET.VALUE(PageStr,"")	Assign a null string to PageStr
33	= ELSE()	Otherwise,
34	= SET.VALUE(PageStr,RIGHT(PageStr,LEN(PageStr)-LEN(TempStr)-1))	Remove from PageStr everything up to (and including) the first comma.
35	= END.IF()	
36	=NEXT()	Repeat the loop until PageStr is empty.
37	=RETURN()	Quit
38		
39	PrintError	Executed on printing error
40	=ERROR(TRUE)	
41	=ALERT("Could not interpret your pages. Please make sure they conform to the example.",3)	tell user about error
42	=RUN(PrintStart)	give user another chance
43	=RETURN()	Stop macro
44		
45		
46	Sheet Name	Value
47		
48	PrintFrom	2
49		
50	PrintTo	2
51		
52	TempStr	2
53		
54	PageStr	
55		
56	PrintMenu	
57	Print &Range Ctrl+Shift+R	PrintStart

to a halt. On the other hand, if the =ERROR(TRUE,PrintError) statement in line 29 were moved up to line 21, then a valid print string that includes commas would also cause the macro to fail. Mr. Arndt's solution simply defers error checking until the macro has had a chance to parse the user's entry.

One final note: The PRINT statement in line 30 uses whatever options you've currently set via Excel's Print dialog box. For example, if you've selected the Preview check box there, the macro will direct your output first to the print previewer, allowing you to print or cancel as you choose. If the check box is clear, output goes straight to the current printer. If you want to ensure that the print preview is always used, you can change cell A30 to read

```
=PRINT(2,PageFrom,PageTo,,,TRUE)
```

Other optional parameters for the PRINT function let you specify multiple copies, whether to print cell notes, and whether to use the "fast, but no graphics" printing method.

Sequential References

Is there an easy way to index linked spreadsheet names? I'm working on a data-collection application in Quattro Pro in which I reference a series of external worksheet files with numeric names. I've got a series of formulas that look like this:

```
+[R21001]C$14
+[R21002]C$14
+[R21003]C$14
```

and so on. It's a nuisance to have to create these formulas by hand. I'd like to find some way to automate the process. So far the best I've come up with is the following sequence:

1. Use the /Edit | Fill command to create a series of numbers—for example, from 21001 to 21020.
2. Use /Edit | Search to search for 21 and replace with '[R21.
3. Enter]C$14 in the first cell of the adjacent column and copy down to match the length of the first column.
4. Print the two columns to a file.
5. Import the file as an ASCII text file.
6. Use /Edit | Search to eliminate the spaces before the closing brackets.
7. Use /Edit | Search to replace '[R21 with +R21.

Is there a simpler way?

D. W. King
Stillwater, Oklahoma

▶**PC MAGAZINE** Yes, there's a simpler way. Try this:

1. Use /Edit | Fill to create a series of numbers—for example, 21001 to 21020. (I'll assume these numbers are going in A1..A20, but you could put them anywhere.)
2. In B1, write the formula

```
+"["&@STRING(A1,0)&"]C$14"
```

3. Copy this formula into B2..B20.
4. Use /Edit | Values to convert the formulas in B1..B20 to their current values.
5. Do a search-and-replace on B1..B20, converting '[to +[.

Bear in mind that your data-collection technique creates links to a lot of different external files. If the total number of files open in memory plus referenced external files exceeds 62, Quattro Pro will give you an error message. □

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When reviewing color scanners in their December 91 issue MacUser had these remarks concerning the Tamarack scanner;
"... exhibited excellent color accuracy." and "... the fastest at scanning the 8-x-10 inch image."

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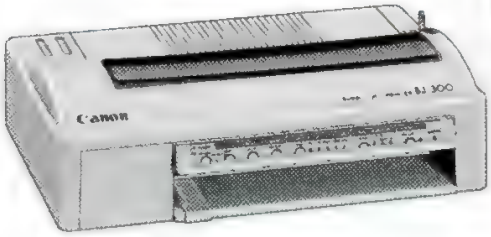

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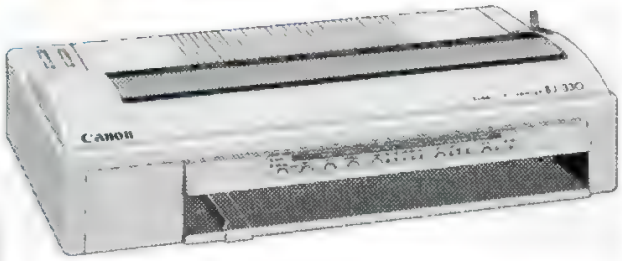

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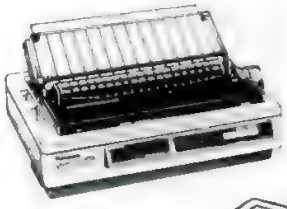

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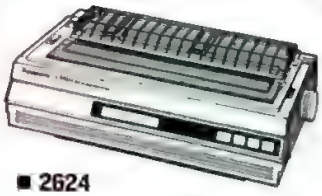

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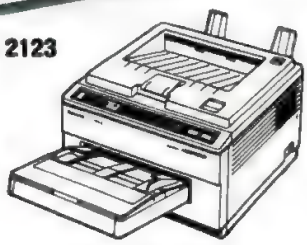

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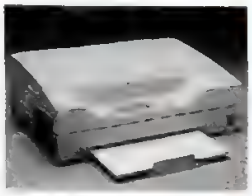

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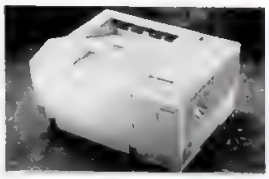

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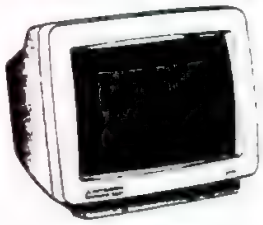

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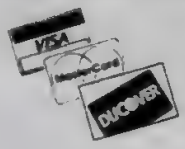

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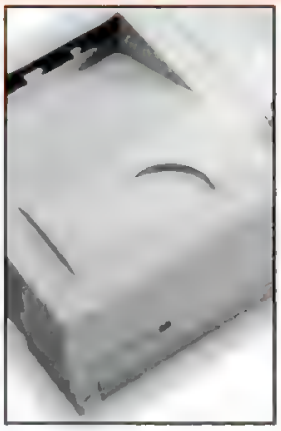

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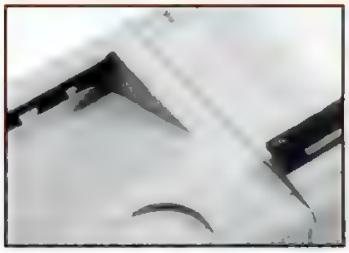

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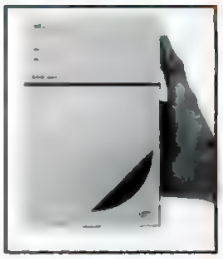

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Expansion boards for all models 70, 80, 90, and 95
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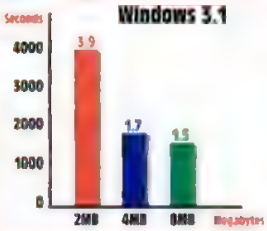

- An upgrade from 2MB to 8MB can increase performance up to 160%.
- Memory allows Windows to run faster.
- Reduces your system's need to access the hard disk.
- Speeds up programs which use virtual memory.
- Allows you to utilize numerous and extensive applications at the same time.

*This graph displays the amount of time it takes to run one specific Windows application with the indicated amount of memory

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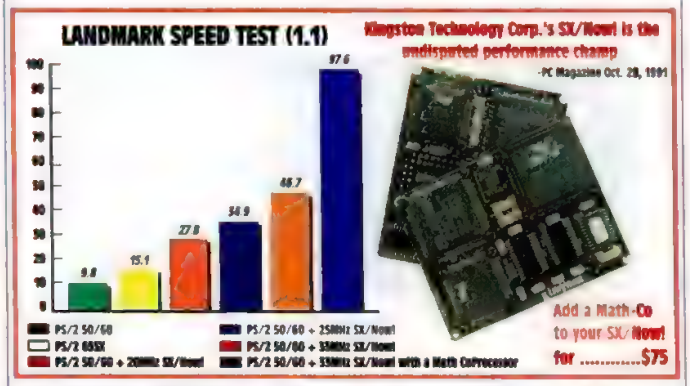

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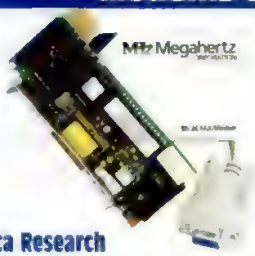

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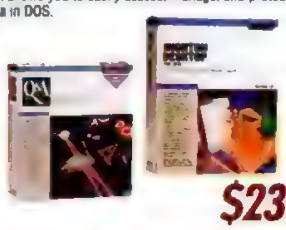

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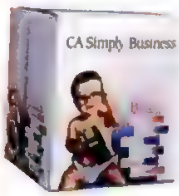

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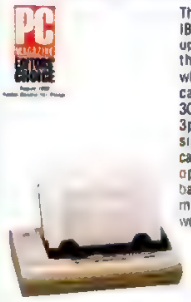

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THE WORKING WORD

Bundled Macros: SmartQuotes, WaterMark, and other macros that ship with WinWord 2.0.

BY M. DAVID STONE

Bundled Macros

Microsoft Word for Windows 2.0 ships with a file, NEWMACRO.DOC, that includes a macro called SmartQuotes. If you take advantage of this macro, then instead of getting straight, typewriter-style quotation marks like " and ' when you type the quote key, you'll get publishing-style curved quotation marks (" " and ' '). The macro also automatically chooses between the opening and closing quote marks, so you don't have to type different keystrokes for these.

To install the macro, first open the NEWMACRO.DOC file from within WinWord. (If you installed WinWord using the full installation, the file will be in your WinWord program directory.) When the file loads, it automatically runs a macro that shows a dialog box with a list of macros. Select SmartQuotes from the list and choose Install.

The next dialog box will let you choose a template to install to. Assuming you want SmartQuotes available to all your documents, designate the NORMAL template and optionally designate a menu and shortcut key to attach the macro to. Then choose OK. The install routine in NEWMACRO.DOC will install the macro into your NORMAL template and automatically save the changes to disk.

You can now exit NEWMACRO.DOC. Once the feature is installed in the NORMAL.DOT template, you can turn SmartQuotes on at any time by running the macro AutoEnableSmartQuotes or turn them off by running AutoDisableSmartQuotes.

Will Martin
Afton, Virginia

▶PC MAGAZINE If you haven't discovered SmartQuotes yet, you should definitely take a look at it, along with the other macros that ship with WinWord. There are a total of about 20 macros (or sets of macros) in the NEWMACRO.DOC file. Since the documentation for these ranges from slim to nonexistent, in this issue I'll discuss the ones that you are most likely to find useful.

Under the category of First Things First: If you can't find NEWMACRO.DOC on your hard disk, you can install just the one file. To do this, simply reinstall WinWord, choosing Custom Installation, and tell WinWord to install sample templates only. If the installation routine asks whether to overwrite specific .DOT files, answer No to avoid losing any changes you've already made to the templates.

The SmartQuotes macro's rounded quotation marks certainly have a more attractive and published look than the straight up-and-down foot and inch char-

AutoInsertDoubleQuote

Complete Listing

```
Sub MAIN
DisableInput
   If SelInfo(27) Then
      Insert Chr$(34)
      Goto bye
   End If

   stWhite$ = Chr$(34) + Chr$(147) + Chr$(148) + "({[=<>"
   SelType 1
   Dim fcdlg As FormatCharacter
   GetCurValues fcdlg
   If(CharLeft(1, 0) = 0) Then
      FormatCharacter fcdlg
      Insert Chr$(147) 'insert double open quote
   Else
      chPrev$ = Selection$()
'The modification starts here.  First test to see if character before
'is a space. If it is a space, then check two characters back, otherwise
'go back to the rest of the macro as written
      If chPrev$ = " " Then
         If(CharLeft(1, 0) = 0) Then   'if now at start of  file
            CharRight 1  'go back where you started
            FormatCharacter fcdlg
            Insert Chr$(147) 'insert double open quote
         Else
            ch2Prev$ = Selection$() 'If not at start, store char
            CharRight 2 'Go back where you started
            FormatCharacter fcdlg
            If ch2Prev$ = Chr$(146) Then 'If two char back is close
                     'single quote
               Insert Chr$(148) 'insert double close quote
            Else
               Insert Chr$(147) 'insert double open quote
            End If
         End If
         Goto Bye
'End of new stuff
      Else
         CharRight 1
         FormatCharacter fcdlg
         If(Asc(chPrev$) <= 32) Or(InStr(stWhite$, chPrev$)) Then
            Insert Chr$(147) 'insert double open quote
         Else
            Insert Chr$(148) 'insert double close quote
         End If
'And add an end if here to go with the additional checking for a space
      End If
   End If
bye:

End Sub
```

Figure 1: **As shipped, the WinWord macros for SmartQuotes will enter opening double quotes after a single space that follows a single closing quote. This addition causes the macro to enter a closing double quote after a closing single quote followed by a space.**

acters. There are actually four macros involved in WinWord's SmartQuotes: AutoEnableSmartQuotes, AutoDisableSmartQuotes, AutoInsertSingleQuote, and AutoInsertDoubleQuote. As the names imply, the first two macros enable and disable the SmartQuotes capability, the third is responsible for inserting single quotes, and the fourth for inserting double quotes.

If you take a look at each of these four macros (by choosing Tools | Macro, highlighting the macro name, and then choosing Edit) you'll see that AutoEnableSmartQuotes uses the Tools-Options Keyboard command to attach the macro for double quotes to the shifted quote key and the macro for single quotes to the unshifted quote key. The AutoDisableSmartQuotes macro uses the same command to reset both keys to their defaults.

As you might expect, the two macros that actually produce single or double quotes function similarly. In each case, they first check to see whether the current window is a macro-editing window. If so, they use the default typewriter-style quotes, since this is the only kind allowed in macros.

In addition, they can decide whether or not to enter an opening or closing quote based on certain conditions. But this approach is not foolproof. For example, sometimes when you have nested quotes, you will want to put a space between the two ending quotes to separate them so that it's easy for the reader to see them. If you add the space, however, the macro as shipped will provide opening quotes rather than closing quotes for the final double quotation mark.

Fortunately, there is an easy fix for this problem. Figure 1 shows several lines that you can add to the macro to accommodate this situation. Use the Tools | Macro | Edit command to open AutoInsertDoubleQuote and type the new lines immediately below the line

```
chPrev$ = Selection$()
```

(and make sure you don't forget to insert the additional End If just before the end of the macro). Finish by closing and saving the macro. Then choose File | Save All, and answer Yes when WinWord asks whether to save global glossary and command changes.

These new lines first check to see whether the character just before the cursor position is a space. If not, the macro continues. If it is a space, these new lines look at the character before the space. If that second character is a single closing quote, the macro will enter a closing double quote at the original position. Otherwise, it will enter an opening double quote.

One last note: WinWord 1.*x* shipped with a similar set of macros. A minor complication in Version 1.*x* was that the spell-checker did not recognize a single curved quote as equivalent to a straight up-and-down apostrophe. If this was an issue for you with WinWord 1.*x*, be aware that the WinWord 2.*x* spell-checker treats the two characters as totally interchangeable, so that the problem no longer exists.

Figure 2: **An example of a watermark created by the PostScript-based WaterMark macro, which is supplied with WinWord in the NEWMACRO.DOC file.**

A POSTSCRIPT WATERMARK In the last installment of The Working Word I discussed how to insert a WordArt image into a WinWord header so that it would show on each page of a document. You can take advantage of this capability, which WinWord calls a *watermark*, to create such effects as printing *Draft* or *Confidential* in large letters on each page, with the document text still visible.

As I mentioned at the end of that discussion, WinWord also comes with a WaterMark macro that works with PostScript printers only. The macro uses essentially the same techniques as a WordArt-based watermark. But instead of storing a WordArt image in the header, it enters a Print field code in the header. The field code sends a short PostScript program to the printer to create the watermark image.

Figure 2 shows a watermark created with the WaterMark macro. This macro offers a far more sophisticated font design than you can manage with WordArt. It also offers more control in some ways, letting you specify the amount of rotation precisely in degrees, along with point size, position, and format.

When you run WaterMark, you'll first see a dialog box. There you enter the text for the watermark; choose the font, size, rotation, and other details; then choose OK. The macro takes care of everything else. The watermark in Figure 2 uses Times Roman font formatted with All Caps, Bold, and Shading with font size set to 90 points and rotation to 45 degrees.

Note that the WaterMark macro assumes when you start it you are in Page Layout view, or are in either Normal or Outline view with the header and footer panes closed. If you are in Normal or Outline view with the header or footer visible, the macro will fail, giving the error message "Command is unavailable." To recover, simply close the header or footer pane and give the WaterMark macro another try.

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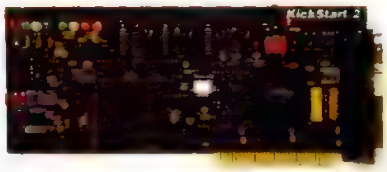

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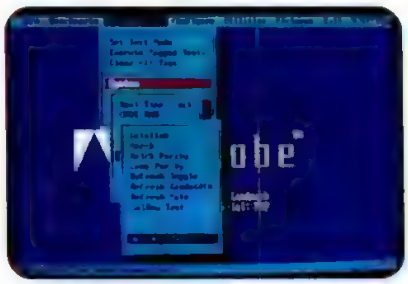

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LAUNCHING OTHER PROGRAMS NEWMACRO.DOC includes four macros for launching other programs from within WinWord—LaunchExcel, LaunchMicrosoftMail, LaunchPowerPoint, and LaunchDialogEditor. Launching, in this case, means either loading and starting the program or switching to the program window if it's already running.

The first three macros function similarly in that they all assume that the directory for the program to launch is included in your system's path. If it isn't, the macros will be able to find an already open window for each program, but they won't be able to load the programs from disk. If you don't want to go through the trouble of adding each program directory to your path statement, you can still make the macros work, simply by editing them to include the full path.

To modify the macro, open it (with Tools | Macro | Edit) and look for the Shell command. In LaunchExcel, for example, the command is

```
Shell "Excel"
```

The next step is to change the command inside the quotes to include the drive and program directory for Excel. The macro will now be able to load Excel, even though the program is not in your path statement.

The fourth macro in this group, LaunchDialogEditor, is much longer than the other three because it includes several additional steps to look for the program file. If the Dialog Editor isn't already running, the macro looks for a reference to it in the WIN.INI file and, failing that, searches all local drives. Using this strategy you should be able to find the Dialog Editor program file if it's anywhere on your system.

OTHER MACROS This short discussion covers fewer than half of the choices in the NEWMACRO.DOC file. There are other macros that help you with indexing, tables, drop caps, network template storage, and more. And it's well worth taking the time to explore them.

One other macro included in the NEWMACRO.DOC that is worth special mention is the InstallMacro choice, which will let you copy or move any macro installed in the current template to any other template. This macro also lets you designate a file and shortcut key to attach the macro to. This macro-management macro can be an invaluable tool for people who use multiple templates. Most important, using InstallMacro makes life far easier if you belatedly discover you've stored a macro in the wrong template so that the macro is unavailable just when you want to use it. □

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Tell the Working Word your latest word processing discovery; we'll pay you $50 for any tip we print. Please send your contribution on-disk along with a printout to The Working Word, *PC Magazine,* One Park Ave., New York, NY 10016, or upload it to PC MagNet (see page 12 for access instructions). We regret that we are unable to acknowledge submissions or answer questions individually.

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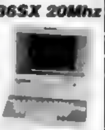

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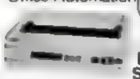

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Turbo Vision Developer s Toolkit	103
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W Packrat 4 1	245

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Screen Extender Wordperfect 2 0	59
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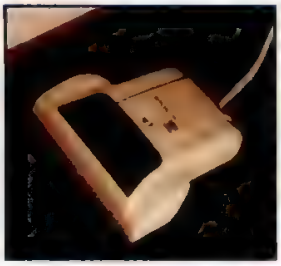

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T3100SX,T3200SX/SXL	2MB	89.00
	4MB	159.00
T1200EX,T1600,T3100E	2MB	89.00
T3200	3MB	149.00
T5100	2MB	89.00
T5200,T5200C,T8500SL	2MB	89.00
	8MB	319.00
T3100	2MB	189.00
T4400,T6400,T3300SL	2MB	139.00
	4MB	269.00
T3300SL	6MB	395.00
T4400,T6400	8MB	549.00

IBM

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	4MB Mem.	139.00
	8MB Mem.	299.00

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Portable386/20	1MBKit	179.00
	4MBEXP	459.00
Portable LTE286	1MB BD	119.00
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	4MB BD	169.00
Portable LTE386S/20	1MB BD	179.00
	1MB BD	89.00
	4MB BD	219.00
SLT/286	1MB BD	79.00
	4MB BD	289.00
SLT/386	2MB BD	169.00
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Prospeed SX/20	1MB BD	129.00
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Prospeed 286	1MB BD	99.00
386SX/16	2MB BD	219.00
	4MB BD	299.00
Ultralite III	2MB	159.00
NEW	4MB	319.00
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ALPHA	2MB	139.00
BETA	2MB EXP	149.00
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Slimsport 286e	4MB MD	269.00
Turbosport 386e	1MB BD	89.00
	4MB BD	339.00
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Sharp PC-6220 Notebook	1MB BD	129.00
TiTM2000	1MB BD	99.00
TiTM3000	2MB Kit	89.00
Everex Tempi LX	2MB MD	99.00
Panasonic CF-170,270, 370	1MB CD	69.00
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Mac Ici,IIsi	4MB Kit	179.00
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Mac IIfx	4MB Kit	189.00
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	1MB MD	89.00
	4MB MD	169.00
DP 286N, 386N, & 386SX/20	1MB MD	59.00
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	OK BD	89.00
DP 386/16	1 MB BD	239.00
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80-041	1MB	79.00
80-111,31	2MB	99.00
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OKI Laser 400	1MB Module	89.00
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OKI Laser 800,820	2MB Module	129.00
	4MB Module	199.00
Panasonic 4450	1MB Module	119.00
Panasonic 4420, 4451	2MB Module	119.00
	4MB Module	199.00
Panasonic 4455	2MB Module	159.00
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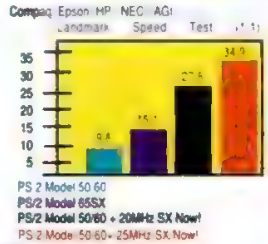

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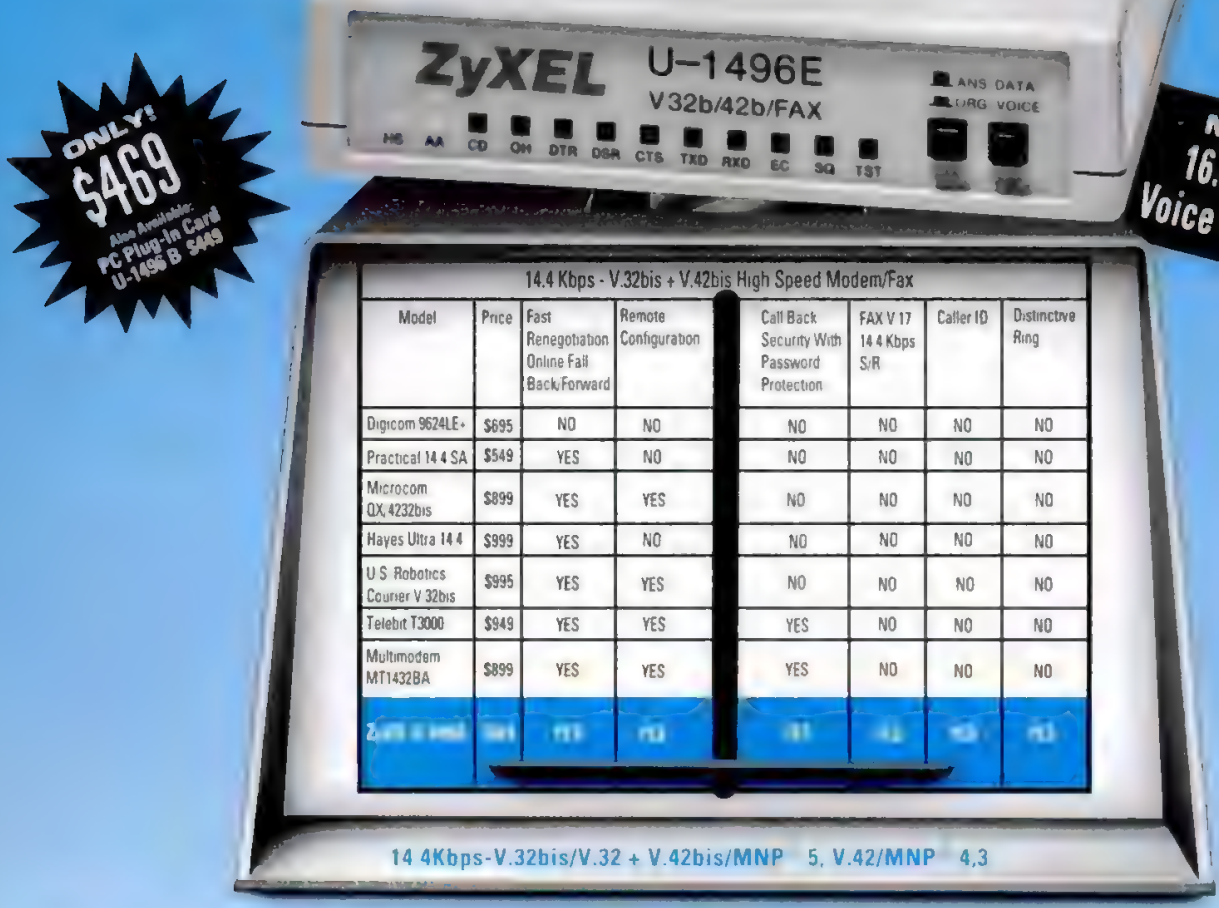

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Hayes Ultra 14 4	$999	YES	NO	NO	NO	NO	NO
U S Robotics Courier V 32bis	$995	YES	YES	NO	NO	NO	NO
Telebit T3000	$949	YES	YES	YES	NO	NO	NO
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PC Professional

Editor's Choice: ZyXEL U-1496E
German Edition, 4/92

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	120MB	15ms	$295
	200MB	15ms	$409
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	120MB	16ms	$285
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CM205XBK Internal 375 ms Drive Only $325

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VC126 16 Bit VGA 1MB $59
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STBAVGA1 16 bit 800 x 600 256K $Call
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COMPUTER PERIPHERALS
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2400 Pocket $79
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9600 FAX Card 2400 Internal $87
9600 External V.42 MNP $265
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14.4 External with FAX $295
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Optima 2400 External $129
Optima 9600 V.32 Internal $349
Ultra 9600 14.4 V.32 External $638
Ultra 9600 External $599
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Satisfaction Modem 200/400 $306/406
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2400 Pocket with 9600 FAX $96
9600 Fax Card 2400 Internal $49
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2400 Internal Fax Modem $89
Pocket 2400 $98
9600 Internal $258
9600 14.4 External w/FAX $388
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16.8 External HST w/FAX $518
16.8 External HST Dual Std w/FAX $725
2400 Sportster External V.42 $145
14.4 Sportster w/Fax External/Internal $309/299
14.4 Sportster External/Internal $282/269
Worldport 2400 Pocket w/9600 FAX $219
Shared Access Modem Kit $579
Sportster 9600 External $272
Sportster 9600 External w/Fax $275

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387-20/25/33 $85
387-SX 16/20 $79
CYRIX SYSTEMS
Mathco 387-SX 16/20/25 $55/55/58
Mathco 387-20/25/33 $63
Mathco 387-40 $79

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256 x 4 chips $4
256K/1MB Simms $11/34
4MB Simms 70 nano $128
NMB 1MB-9-05/1MB-9-04 $48/51

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A2600 Add One User Kit $199
A2700 Add One Portable Kit $259
A2100 16 Bit Ethernet AUI & Coax $94
A1500 16 Bit Ethernet 10 Base T $94
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2mbps/AE2/AE3 $325/448/529
Lantastic LAN Cards
2mbps/AE2/AE3 $129/198/229
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Etherlink II 10 Base T/
Five Pack (3C503TP) $169/719
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Etherlink 16 (3C507) $279
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IBM
Token Ring Adapter $598
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Novell Lite $69
Ethernet NE1000/NE2000 $129/155
Netware V2.2 5 User $485
Netware V2.2 10 User $1079
Netware V2.2 50 User $1859
Netware V3.11 5 User $629
Netware V3.11 10 User $1399
OLICOM
16/4 Token Ring Adapter ISA $388
SMC
Ethercard +/+16 $119/149
THOMAS CONRAD
TC6242/TC6242-TP+ $69/99
TC6245/TC6245-TP+ $199/219
TC4045 16/4 Token Ring $499

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Laserjet IIP + w/Toner $808
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DAC Easy Acctg/Payroll
DAC Easy Bonus Pak 119
DAC Easy Point-Of-Sale
DAC Easy Instant Acctg.
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Money Counts
One Write Plus Accounting
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One Write Plus Works
Pacioli 2000 2.0
Peachtree Complete Accounting 172
Profitwise Power Pak 272
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DesignCAD 6.0 172
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FastCAD
Generic 3D Drafting
Generic CADD 6.0
Mathcad 2.5
Mathcad-Adv. Math Apps 75
Turbo CAD 79

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Britannica Family Choice
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Comptons Family Encyc.
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Corel Stockbuster-ext-AT
Corel Stockbuster-int-AT
Corel Draw 3.0
Creative Labs Upgrade Kit
Groliers Encyclopedia
Mammals
MS Beethoven
MS Bookshelf-DOS 137
MS Bookshelf-Windows 137
MS Multimedia Dev. Kit
MS Programmers Library
MS Word For Windows & Bookshelf
MS Works for Windows
Multimedia Toolbook
Pro Audio Spectrum Plus
Pro Audio Spectrum 16
Pro 16 Multimedia System
Soundblaster
Soundblaster Pro
Thunderboard
Thunderboard For Windows
Timetable of History 77
US Atlas (S. Toolworks)
World Atlas (S. Toolworks)

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Carbon Copy Plus
Close-Up Customer 119
Close-Up Dual Pak
Close-Up Support 147
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Compuserve Membership Kit
Crosstalk Mark IV
Hyperaccess
Laplink Pro 4.0
PC Anywhere 4.5 112
PC Anywhere III
Procom Plus
Prodigy Start-Up Kit

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Clarion Personal 47
Clarion Professional
Clipper 5.01
Dataease 4.5
Dataperfect 272
dBase III Plus 1.1
dBase IV 1.5
DBXL 1.3R
Foxbase Plus 2.1
FoxPro (Microsoft)
FoxPro Competitive Upgrade
FoxPro Construction Kit
FoxPro Distribution Kit
FoxPro LAN (6-Pak)
Genifer
Paradox 4.0
Paradox Comp. Upgrade 177
Paradox SE
PC File 6.5
Professional File
Q & A 4.0
R & R Code Generator
R & R Reportwriter 4.0

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PFS: Publisher
Publish-It 2.0
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Ventura Gold for DOS

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Calendar Creator Plus
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Deluxe Paint Animation
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Drawperfect
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Formfiller
Formtool Gold
Formworx for DOS
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Lotus Freelance Graphics
Multimedia Explorer (Autodesk)
PC Globe
PC Paintbrush 5 Plus
Pizzaz Plus
Printmaster Plus
Printshop
SPSS/PC Advanced Stats
SPSS/PC Base 179
SPSS/PC Stats
SPSS/Tables

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Kraft Trackball
Logitech Mouseman-Ser.
MS Mouse
MS Mouse w/Paintbrush
MS Mouse w/Windows
Scanman 256
Trackman
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Lantastic Ethernet Starter
Lantastic Ethernet Ad.
Lantastic for Windows
Lantastic for Windows Starter
Lantastic Starter Kit
Main LAN Easy Starter
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Novell Netware 2.2-10 u.
Novell Netware 3.11-5 u.
Novell Netware 3.11-10 u.
Novell Netware 3.11-20 u.
Novell Netware Lite / Dr DOS 6.0

PROJECT MANAGEMENT

Harvard Project Mgr.
Org Plus Advanced
Project Scheduler V
Superproject 2.1 DOS
Timeline 5.0

PROGRAMMING

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Brieve for DOS
K-Edit 5.0
MS Basic PDS 7.1
MS C Compiler 6.0
MC Cobol Compiler 4.5
MS Fortran 5.1
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MS Quick C w/Assembler
MS Quick Pascal
MS Quickbasic 4.5
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Powerbasic 2.1 77
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Lotus Works
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Quattro Pro 4.0
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Supercalc 5.5
Word Perfect Works

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Address Book Plus
Ami Diag 4.0
Automenu
Battery Watch Pro
Central Point Anti-Virus
Central Point Backup
Check-It Plus
Copy II Del. Option Board
Copy II PC
Dan Bricklins Demo II
Desqview 2.4
Desqview 386 2.4
Direct Access 5.1
Disk Manager for DOS
Disk Optimizer
DOSFax Pro
DR DOS 6.0 / Netware Lite 1.1
Fast Fonts-DOS
FAST!
Fastback Plus 117
Fastpak Mail
Fastrax
Flight Simulator
Go-Script 4.0
Go-Script Plus 4.0 179
Hi-Jaak 125
IBM PC DOS 5.0 119
Infoselect 2.0
Instant Recall
Label-Pro Laser or Dot
Labels Unlimited
La Menu Plus
Lotus Agenda
Lotus Magellan
Mavis Beacon Typing
Menuworks Personal
MS DOS 5.0 Upgrade
MS DOS 5.0 w/GWBasic
MS Learning DOS
Norton Anti-Virus 2.0
Norton Backup 2.0
Norton Commander 3.0
Norton Desktop DOS
Norton Utilities 6.01 119
NOVI Anti-Virus
Optune 1.3
Pathminder Plus
PC Tools 7.1
PCKwik/Powerpak/PowerDisk
Powermenu Plus
Print-Q
Printcache
Prokey Plus
QA Plus
QDOS III
QEMM 386 6.0
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Sim City
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Typing Tutor V +
Ultrascript PC 3.01
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Willmaker 4.0
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WordPerfect Office 3.1
WordPerfect Office (5u)
Wordstar 7.0
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WINDOWS

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Access to Platinum-Win.
ACCPAC Simply Acctg-Win. 119
Amortizer Plus Windows
Approach For Windows
dBfast for Windows
M.Y.O.B. Accounting 132
MS Money for Windows
Paradox For Windows
Peachtree Acctg. Windows
Quicken for Windows
Superbase 4 Windows
Turbo Tax Windows

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Adobe Illustrator 4.0
Aldus Photostyler
Express Publisher for Windows
Framemaker Windows
MS Publisher
MS True Type Font Pak
Omnipage Prof. 2.1
Pagemaker 4.0
Ventura Gold 4.0 Windows
Wordscan Plus 1.1

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ABC Flowcharter/Windows 172
Animation Works Interactive
Art & Letters Graph. Ed.
Autosketch for Windows
Calendar Maker
Corel Draw 3.0 + CD
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Formworx for Windows 102
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Lotus Freelance Gr -Win.
Mathcad for Windows 3.0
MS Powerpoint
MS Project Windows 3.0
Org Plus Adv. Windows
Perform Pro 172
Photofinish 119
Presentation Task Force 122
Softtype 112
SPSS-Base Windows
Superpaint Windows
Timeline for Windows
Windows Draw

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Borland C + + /Framework
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MS C + + Windows 7.0
MS Quick C Windows
MS Test for Windows
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MS Works For Windows 127
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Simply Business (Comp. Assoc.)
Windows Works 72

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Adobe Type Manager
Adobe Type Mgr. Plus Pak
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After Dark for Windows
Automap Windows
Back-It for Windows 47
BitFax Windows
C.P. Anti-Virus For Windows
Carbon Copy Plus/Win.
Crosstalk for Windows 117
Direct Access Windows
Facelift For Windows
Fast Fonts-Windows
Fastback Plus Windows 117
Fax Grabber
Hi-Jaak Windows 125
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MS Productivity Pak
MS Windows 3.1
MS Windows 3.1 / DOS 5 Upgrade
MS Windows 3.1 Upgrade
MS Windows 3.1 / DOS 5 Upgr
MS Windows Debugger
Norton Backup Windows
Norton Desktop Windows
Outside In/Windows
Packrat 4.0
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QA Plus For Windows
Sim City Windows
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Up To Date
Winfax Pro
Winmaster
Winsleuth Pro 2.0
Wintools
Wired For Sound
Wired For Sound Pro 47
Word for Word Windows 47
Xtree for Windows

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Grammatik for Windows
MS Word for Windows
MS Word/Windows Upgrade
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Rightwriter for Windows
Tasker (Computer Assoc.)
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WordPerfect Win. Spanish
WordPerfect Win. Station
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Zyindex for Windows

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Lotus 1-2-3 Unix (5-Node)
Lotus 1-2-3 Unix-Server
SCO Foxbase + 386
SCO Unix 386 Development
SCO Unix Operating-2 user
SCO Unix Operating System
SCO VP/IX 3 + users
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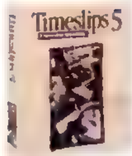
WordPerfect Unix (5u)
WordPerfect Xenix (1u)
Xtree for Unix 102



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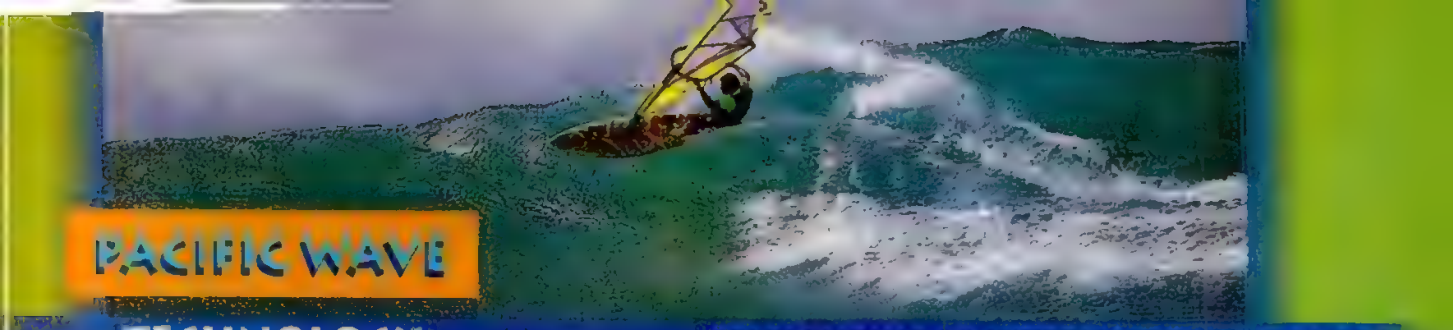

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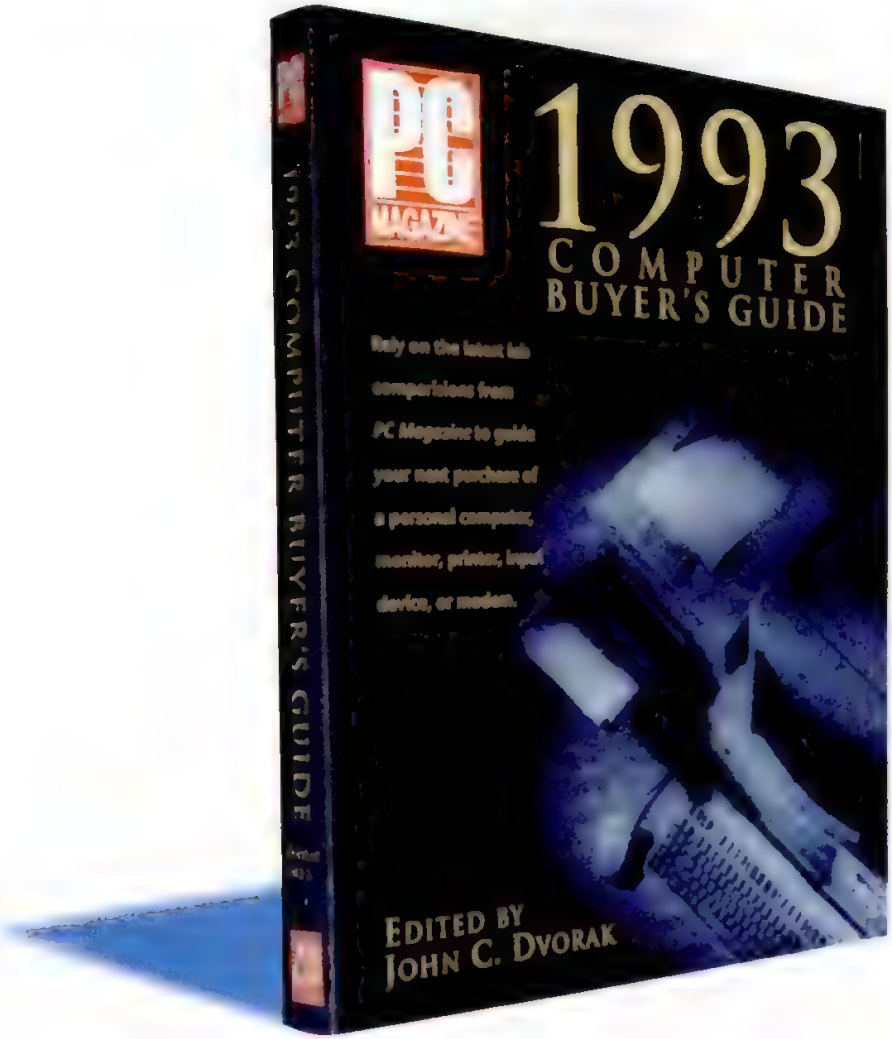

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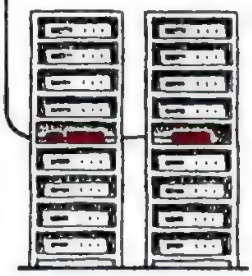

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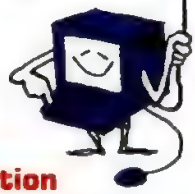

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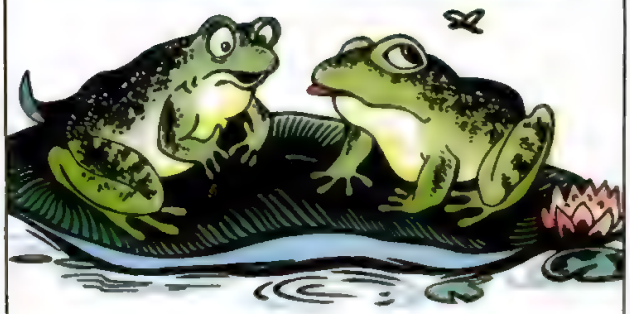

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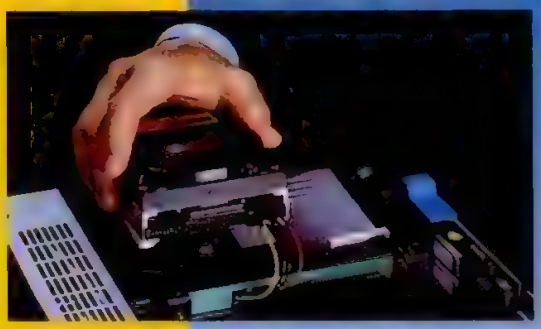

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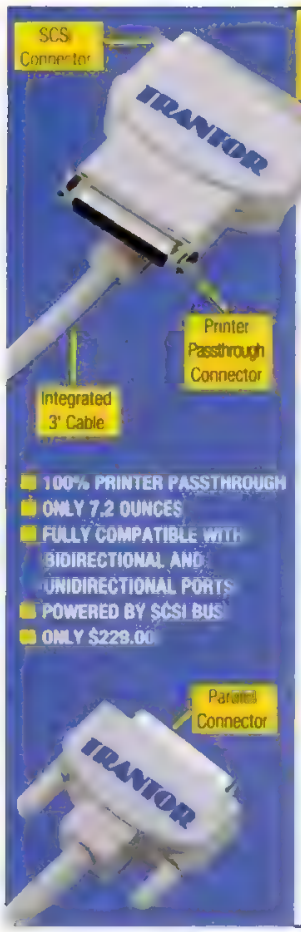

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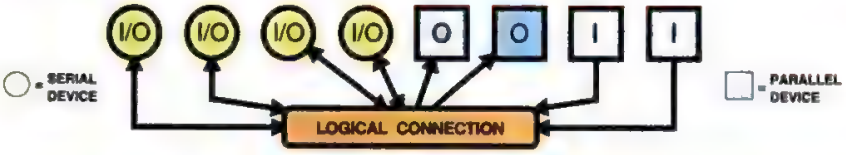

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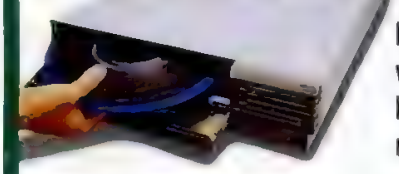

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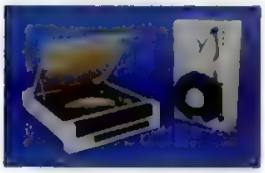

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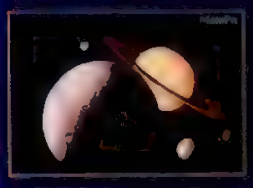

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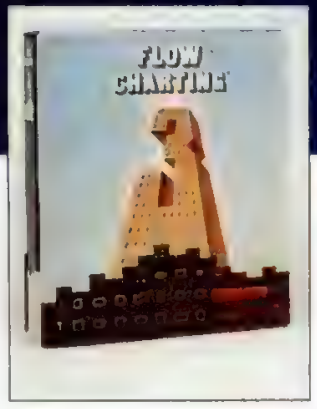

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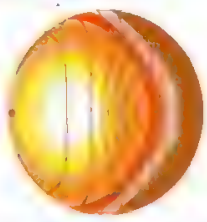

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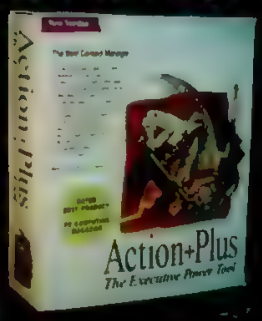

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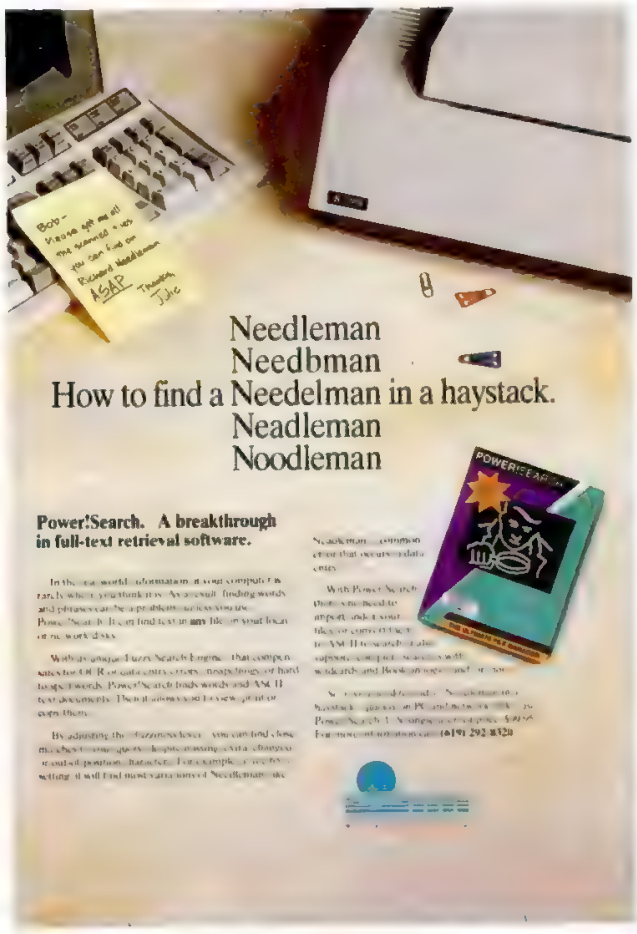

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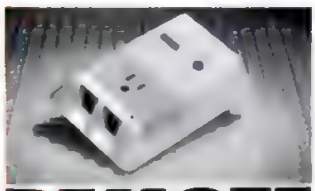

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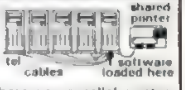

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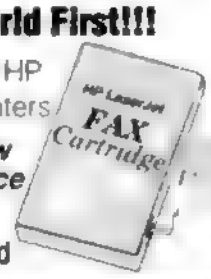

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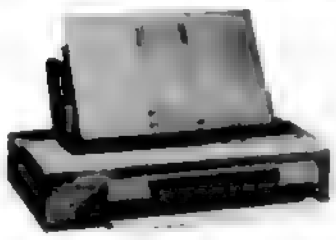

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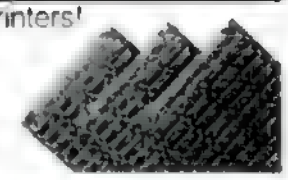

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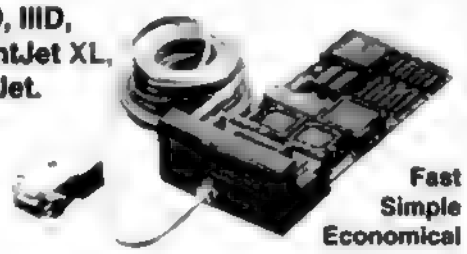

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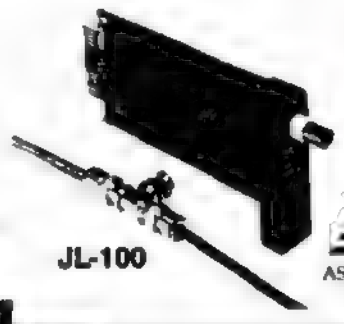

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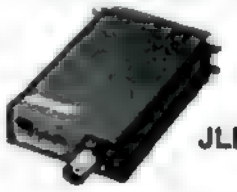

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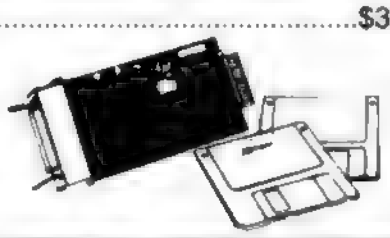

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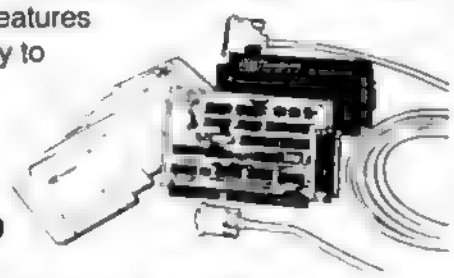

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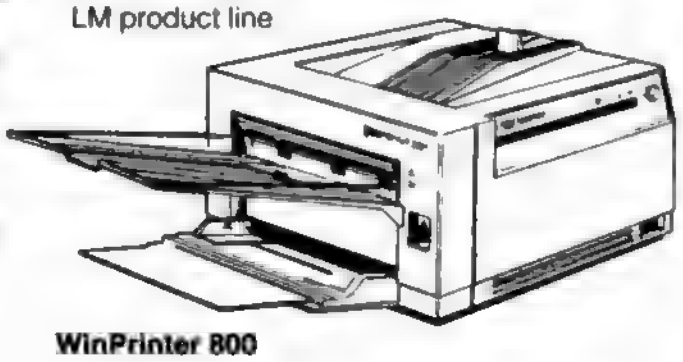

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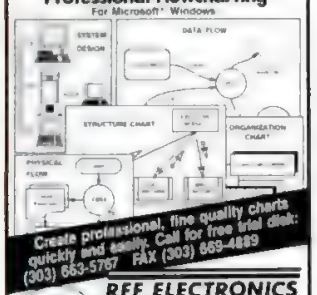

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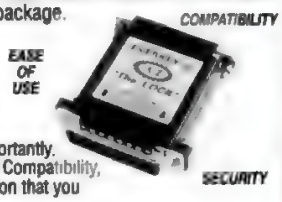

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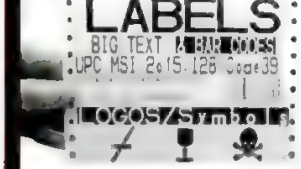

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PC 11/24-6

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06.☐ Computer Retailer/VAR/VAD Distributor
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4. Is your company a reseller?
01.☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:
01. ☐ 10 or less 03. ☐ 26-99
02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)
01.☐ Linked to mainframe
02.☐ Linked to mini
03.☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply)
01 ☐ IBM or Compatible PCs
02 ☐ IBM or Compatible Mainframes
03 ☐ IBM or Compatible Minis
04 ☐ Macintosh
05 ☐ CD-ROM
06 ☐ Windows

8. Do you plan to buy any PC Products?
01.☐ Now
02.☐ In 4 to 6 months
03.☐ In 7 to 12 months
04.☐ No definite plans

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835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881
882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928
929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975
976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022
1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	[illegible]	1055	1056	1057	1058	1059	1060	1061	1062	[illegible]	1064	1065	1066	1067	1068	1069
1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116
1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163
1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200										

PC 11/24-6

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06.☐ Computer Retailer/VAR/VAD Distributor
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10.☐ Government—Federal
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14.☐ Health/Medical/Legal Service
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99.☐ Other

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02. ☐ 11-25 04. ☐ 100 or more

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02.☐ Linked to mini
03.☐ Networked together

7. Please check the equipment currently installed at your location:
(Check all that apply)
01. ☐ IBM or Compatible PCs
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04. ☐ Macintosh
05. ☐ CD-ROM
06. ☐ Windows

8. Do you plan to buy any PC Products?
01.☐ Now
02.☐ In 4 to 6 months
03.☐ In 7 to 12 months
04.☐ No definite plans

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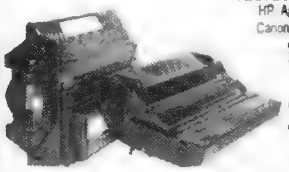

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PC MAGAZINE

Coming Up

Upgradable PCs

Cost-conscious buyers interested in protecting their hardwar investment have flocked to Intel's OverDrive technology. Bu there are other ways to extend your system's life. *PC Magazin* reviews more than 45 upgradable systems using every approac from chip replacement to zero-insertion-force sockets to pro prietary upgrade cards. Some may even be able to use the up coming Intel P5 processor.

Fax Software

Faxing from the PC has become an attractive option to feedin paper through a machine. *PC Magazine* looks at DOS- an Windows-based fax software to see what strides have bee made in electronic sending and receiving as well as in fax man agement. Products in the review include BitFax/OCR for Win dows, DosFax Pro, Eclipse Fax, FAXit, Fax-Master, MTE with ExpressFax, and SuperFax for Windows.

Communications: 9,600-bps Fax Modems

Now that you've decided on a fax software package that suit your needs, you need a fast, reliable fax modem to carry ou the job. PC Magazine Labs tests all the 9,600-bps fax modem that software companies recommend—along with some we dis covered from our own research. We'll give you all the informa tion you need to pick the right one.

Graphics: 24-bit Paint Software

With true 24-bit color rapidly becoming the graphics standar 16-bit color paint programs such as Windows Paintbrush or th original PC Paintbrush no longer cut the mustard. *PC Magazin* looks at three 24-bit paint packages, and we'll tell you whic programs offer the most and best tools—from airbrushes t watercolors—and might make you the next DaVinci, Dali, o Degas.

Free Utility

Databases are often better at organizing and rememberin names and addresses than printing them. Next issue's utility MLPRINT, will make this process hassle-free. It will tak ASCII text output and print it in a format approved by th U.S. Postal Service on standard LaserJet labels and envelope complete with return addresses. MLPRINT can also prin standard PostNet bar codes for faster, and sometimes more eco nomical, routing of your mail. □

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After Hours

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RETIREMENT SOFTWARE

Four Retirement Packages Prepare You for Your Graying Years

BY DON TRIVETTE

The concept behind retirement planning is simple: Figure out how much money you will need per year when you retire, and calculate how much you'll have to put away now in order to have that income. It's the details that are troublesome. What will inflation do? How might Congress modify Social Security? What will your pension plan cover? How will tax rates change? How will interest rates fluctuate?

No one can accurately predict all the variables that will affect retirement, but everyone should begin to formulate a retirement plan based on some logical assumptions. Four new DOS-based retirement packages can get you started: Harvest Time, Retire ASAP, Retirement Surprise, and T. Rowe Price Retirement Planning Kit.

Of the four programs, Retire ASAP has the most detail. You can record every dollar you might earn and then project its future value. Although the $99 Retire ASAP is the most expensive of the four packages, accountants are sure to love it. Harvest Time ($49.95) takes more of a spreadsheet approach: First you fill out a form, and then a graph shows how long your retirement dollars will last. Harvest Time has very little tutorial guidance; it assumes you understand things like inflation, compounding, and rate of return. It is also my favorite package because it's so easy to use. At $15, T. Rowe Price Retirement Planning Kit is a software bargain. It takes a more tutorial approach than the other programs, but running it is like sitting down with a long-winded financial adviser. The $49 Retirement Surprise is the weakest package, because it has no way to account for a systematic investment program—a fatal flaw.

Last year, those who had already begun to save for their retirement put away an average of $2,079. Will that be enough to retire on in 20 years? These packages help you address that question.

HARVEST TIME

The Computer Lab's Harvest Time is a delight to those who hate to read instruction manuals and tutorial screens. There are few pages of written text, and all the input is accomplished on a single screen.

This input includes your birth year, the age at which you plan to retire, the age at which you plan to begin drawing Social Security, and the amount of yearly retirement income you will need.

In addition to this information, Harvest Time asks you to enter data about your taxable, tax-free, and tax-deferred investments. For each type of investment you enter, you input the contribution, a rate of increase, and a rate of return. Press the F9 key to recalculate and the F10 key to view the bottom-line capital assets graph.

Since Harvest Time doesn't get into the minutia of individual assets, there is no way to set different rates of return for different investments. You can't, for example, claim a 5.5 percent rate for passbook savings and a 7.25 percent rate on CDs. Some retirement planners will find this a problem others a blessing.

The software also fails to check the validity of certain entries. For example, Harvest will accept without warning the declaration that you intend to collect Social Security at age 60—an impossibility under current laws. The developer says the code is there but something went wrong, so expect this bug to be fixed soon.

The idea of retirement planning is to juggle investments and rates of return to match your life span. With the data I used, I would run out of money at age 82, which, according to the software, is my life expectancy. Since I don't trust that I'll be ready for ambient temperature at age 82 (or even 92), I obviously need to increase my annual savings to allow for a margin of error.

Harvest Time comes with three other graphs to help you plan, as well as beautifully printed tables you can ponder. Although the calculations are fairly sophisticated, this is an easy program to use without being too detailed.

Harvest Time gives retirement planners a good overall picture that lacks some detail.

Harvest Time, $49.95.
Requires: *640K RAM, DOS 3.0 or later. The Computer Lab, P.O. Box 415, Lafayette, NJ 07848; 800-397-1456, 201-579-1455.*

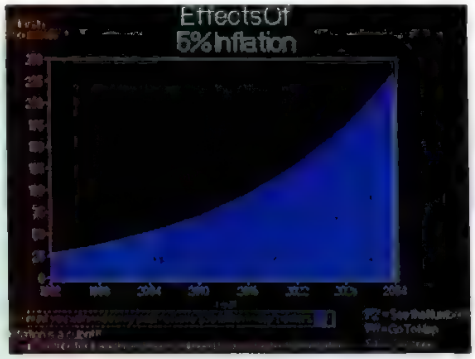
Circle 480 on reader service card

RETIRE ASAP

Who wouldn't like to retire as soon as possible? Retire ASAP takes you through five steps to help you calculate your retirement prospects. First you enter personal information, then answer some questions about your retirement goals. Next, Retire ASAP generates information about your retirement situation based on the answers you provided in the previous two sections. The fourth section—what an expert might say about your retirement—attempts to analyze your plan; the fifth part, called "Once You Retire," is a resource for information about medical care, housing, travel, and sen-

ior citizens' organizations.

Retire ASAP comes with a 150-page instruction manual, about half of which is devoted to an investment tutorial on subjects like mutual funds, choosing a financial adviser, and setting up an IRA. The software is easy to install and requires no particular computer savvy to run, although answering the questions is sure to bring back memories of April 15.



Retire ASAP gives you a graphical or tabular view of your retirement needs.

Retire ASAP lets you record more detail about your net worth and retirement plans than other packages. For example, you can enter figures for a private pension plan, 401(k), tax-sheltered annuities, profit sharing, SEP, Keogh, IRA, and deferred compensation. You can enter your data as a percentage or an absolute dollar amount, and there is a place to enter the terms of various plans when appropriate. On other screens, you record savings accounts, money-market accounts, stocks, bonds, and real estate.

Having this level of input available is fine for those who want it, but you can't enter a summary figure to override the detail. For example, I should be able to enter my liquid assets without having to break them down into money market, checking, and savings accounts. With retirement 30 or 40 years down the road, is it really important that a $5,000 checking account is earning 4 percent interest?

There are lots of help screens, some relating to the operation of the software and others to retirement information. For instance, Congress has changed Social Security so that people born after 1937 cannot retire with full benefits at age 65. It is important to determine at what age you will be eligible for 100 percent coverage, and ASAP bases its calculations on that.

You will come across an annoying design flaw in the first section, however: Although the software asks you to enter your birthday, it doesn't figure out your life expectancy. Instead, the program refers you to a table that begins at age 55. How is one to know the life expectancy of a 30-year-old? On the positive side, the software allows you to set a different retirement age for each spouse, a feature two of the other packages lack.

After you enter all the information, ASAP calculates how well you are doing in your retirement planning. The bottom line with the data that I used showed a need to contribute an extra $216 per year to a retirement plan in order to have an income equivalent to $30,000 in 2027.

Output is both graphical and tabular. If you want a $30,000 annual retirement income, measured in today's dollars, there's an eye-opening graph that shows you will actually need about $140,000 per year in 2022. That's the effect of 5 percent inflation. ASAP has a screen on which to adjust long-term economic considerations such as inflation and rate of return, but I couldn't find it the second time when I wanted to try some different numbers. That points up another flaw: There are places in ASAP where organization is confusing and where it's not easy to get back to a previous screen.

Accounting types will love Retire ASAP; those who plan and project using broader brush strokes won't.

Retire ASAP, $99.00.
Requires: *640K RAM, 2MB hard disk space, DOS 3.0 or later. Calypso Software, 123 Lake St. South, #106, Kirkland, WA 98033; 800-225-8246, 206-822-8581; fax, (206) 889-1611.*

Circle 481 on reader service card

RETIREMENT SURPRISE

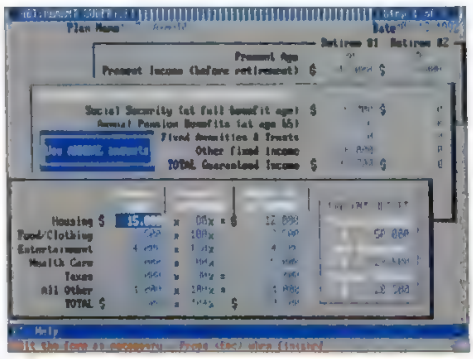
The name of this software suggests what all of us fear: a big, unpleasant surprise when it comes time to hang up the old alarm clock. But the real surprise here is the somewhat limited nature of this software. Retirement Surprise excels in calculating your future needs, but lacks a way to incorporate ongoing investments.

On the first screen, you enter age and current income along with guaranteed sources of retirement income, such as Social Security and pensions. Unfortunately, the program will not compute the amount of Social Security you can expect.

In the next section, you enter current expenses for items like h care, a side the mate the lieve you'll Most peopl would hope t their mortgage so 10 or 15 perce rent housing budg adequate to cove such as insurance an nance. Health care, other hand, is likely to eral hundred percent o rent costs. The object of exercise is to give you a curr budget along with an idea retirement needs.

On the second input screen, Retirement Surprise asks for the present value of assets such as IRAs, bonds, stocks, mutual funds, CDs, and real estate. This is where the software fails to anticipate regular savings programs; there is no way to enter that you plan to save $500 a month or invest regularly in stocks. Without this provision, Retirement Surprise has limited value. The developer said a major new revision, which should address this problem, is due out by the end of the year.

When you get to the third screen, the software reports the results of its calculations. Look down a column of ages until you come to the age where you plan to retire, read



Retirement Surprise calculates present value of certain assets, but ignores future investment plans.

ent Surprise

. and. . . surprise! The s I used told me that I ed to save an extra $1000 nonth to meet my income after it is adjusted for in- ion.

Retirement Surprise may adequate for someone who 63 and planning to retire in wo years, but when you're hat close to retirement age, it's pretty late to begin.

Retirement Surprise, $49.00. Requires: *256K RAM, DOS 2.1 or later. Software Edge Inc., 112 Ocean Bay Dr., Key Largo, FL 33037; 800-321-5250.*

Circle 482 on reader service card

T. ROWE PRICE RETIREMENT PLANNING KIT

T. Rowe Price is one of the country's largest investment advisory services, having both individual and institutional clients. The company has put together Retirement Planning Kit, which includes a lengthy on-screen tutorial on investments as well as sage advice on retirement planning.

The Retirement Planning Kit's main menu features five choices: Investment Planning for Retirement, Calculating the Cost of Your Retirement, Developing Your Retirement Investment Strategy, Building Your Retirement Portfolio, and Requesting More Information. The 70-page manual supplements the software. One helpful feature is a list of all the questions the program asks and the acceptable range of answers. For example, when the program prompts you for an inflation rate, you can enter a figure from 0 to 20 percent.

The first section demonstrates how important it is to begin saving early to take maximum advantage of compounding. The second section is a workbook where you answer a series of questions about your personal finances and your retirement goals. The software then calculates how much you'll need to invest each year to meet those goals. You can change the numbers and see the results of beginning a savings plan later, or what happens if you save a little more each month.

The third section—Developing a Strategy—explains the fundamentals of investing: The greater the risk, the greater the potential gains. T. Rowe Price suggests diversifying investments to reduce risk. This section is little more than a slick version of an introductory college economics course, but the basics are worth reviewing.

The fourth section begins to tout the services and products T. Rowe Price offers. It show three sample portfolios, each with a different goal. The fifth section is an out-and-out directory of the company's services.

The heart of this package is section two—Calculating the Cost of Your Retirement. Here, you enter numbers and see results. The information is presented in a methodical, step by step manner that anyone can understand; there are several graphs to illustrate points. The kit's major flaw is that it does not provide for spouses who retire at different ages. I also dislike that it shows what you should save as a percent of your annual income rather than as an annual dollar amount.

Friendly but verbose, T. Rowe Price's Retirement Planning Kit dispenses advice from one of the country's largest investment advisory firms.

The T. Rowe Price Retirement Planning Kit is a little too wordy in places for my taste (although you can skip sections one, four, and five if you have no need to brush up on investing). If you like the interrogatory approach to planning, however, this is the package for you. It's the ultimate in friendly software.

All of these retirement planning packages emphasize two important points: begin investing for your retirement today, and invest the maximum you are allowed in tax-free and tax-deferred programs such as IRAs.

T. Rowe Price Retirement Planning Kit, $15. Requires: *640K RAM, DOS 3.0 or later. T. Rowe Price Distribution Inc., P.O. Box 15098, Worcester, MA 01615; 800-541-6007, 508-885-4434; fax, 508-855-1000.*

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GAMES

Ultima Underworld's Stygian Abyss: A 3-D View of the Dungeon

BY BERNARD YEE

Ultima Underworld: The Stygian Abyss is a ground-breaking fantasy role-playing game. Origin Systems takes you through a 3-Ddungeon setting that makes exploring this world more fun than ever. The game's advanced shading and bitmapped graphics code turn a VGA display into a window onto an ominous locale.

In this adventure, you play the part of the Avatar, the Galahad-like hero who has appeared in many of the previous Ultima games. This time out, you have been framed for kidnapping the duke's daughter. You are banished to the Stygian Abyss, a dungeon that was once rehabilitated to a colony, then converted back to a dungeon.

Your task is to rescue the girl and clear your name. That mission isn't as straightforward as it seems, though. As you progress through the story, you stumble upon another plot that threatens to unleash unspeakable evil on the land.

When you open your eyes in the abyss, you'll notice that the entire dungeon is modeled in three dimensions, and you see everything from your own point of view. You inch forward, sprint ahead, jump, look up, down and around smoothly and realistically. When you fly, you rise into the air; when you swim, you bob above the waterline.

Other dungeon games use defined static wall sets, and your movement is restricted: you can move 10 feet forward and turn 90 degrees left or right. Ultima Underworld gives you a full 360-degree view that makes the others seem choppy and primitive.

Ultima Underworld

Like its cousins in the Ultima series, The Stygian Abyss pays great attention to details, from the light and shadows to the physical world around you, which is object-oriented. The point-and-click interface allows you to pick up and manipulate (via a drag-and-drop interface) just about every object you see. Even the doors and chests have physical properties. You can scrounge around for the right key, or just pick up a weapon and bash the door down or the chest open. These multiple solutions to a problem make the game more flexible.

Perhaps the standout feature of Underworld is its automapping ability. Beautifully rendered, the map not only records your progress meticulously, but allows you to type notes right on the map, highlighting noteworthy landmarks or nasties. There are even blank pages at the end for your scribblings. You can keep track of mantras (recitations made at shrines which increase your abilities), spell combinations, or take notes of conversations and hints from the multitude of benign nonplayer characters that inhabit the Abyss.

Everything (including combat) in this game takes place in real time. The magic system requires you to find rune stones and combine them in the proper order to harness arcane forces.

Because the game is so graphics intensive, it requires a 386SX processor, at least 2MB of RAM, and as much as 13MB of hard disk space. If you're short on resources, you can pare the storage requirement to 8MB by choosing not to install some of the files.

The game also has a handful of shortcomings. Ultima Underworld's first release had some bugs, some of which have been corrected in later versions or patches. The other creatures don't look particularly de
and sou
more effe
the music,
and graphic
geon experie
soon forget.

Ultima Unde
you to explore a
above and below
realistic fashion tha
been seen previously
much detail in
and nightmares. □

Ultima Underworld's three-dimensional, 360-degree views make the Avatar's adventure the most realistic and detailed of the Ultima series.

Ultima Underworld. The Stygian Abyss, *$69.95.* Requires: *386/16-based PC or better, 2MB RAM, 13MB hard disk space, DOS 3.3 or later. Origin Systems, 206 Wild Basin Rd., #207, Austin, TX 78746; 800-999-4939, 512-328-5490; fax, 512-328-3825.*

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Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

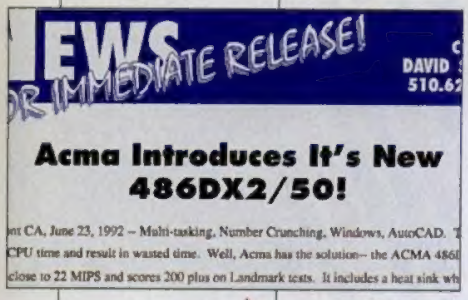
By Bill Howard

According to this ad from Foley's department stores of Texas, Oklahoma, and Arizona, Brother's $399 word processing typewriter with display also runs Windows. While the 720K floppy disk drive may be PC-compatible, the rest of the machine isn't.

Maybe It Was a CD-RAM Drive InfoWorld Tested?

"But to do multimedia right, avoid the least expensive units and go for a sound card with better audio (Turtle Beach's MultiSound, while not cheap, is one of the best). And if you plunk down your hard-earned cache for a CD-ROM drive, don't get one with an access time longer than a third of a second. Also, look for a drive that can support CD-ROM XA; such drives are usually labeled 'XA-ready.' These drives may be necessary to handle Kodak's Photo CDs, as well as the next generation of multimedia applications."

—*InfoWorld*, August 17, 1992



Maybe they'll bundle a spell-checker with the DX2/66 (Acma Computers press release).

Classified Intelligence

"IBM 286 system—Tandy, includes monitor, 20 meg HD, sand blaster, 101 enhanced keyboard. Extra seriel port, in good cond $600."

—*Fresno Bee*, August 8, 1992

At Apple, Well-Dressed Used to Mean "Wears Shoes"

Wardrobe tips for job seekers from Bill McDermott, district market development manager, Apple Computer:

"I'm impressed when someone doesn't wear his best suit to an interview. This is not a wedding. It's much smarter to dress just a little bit better than the customer you'll eventually be dealing with. Not flashier, just more affluent. I'm pleased by someone who looks as if he hasn't bought the outfit whole and then wears it that way all the time. Penny loafers and wingtips signify sure-fire bores. Monograms and pocket handkerchiefs lack originality. Spend a little more on a pair of shoes. One tip: You can tell a man knows how to dress by the way he matches his shirt collar to his suit."

—*The New York Times Magazine*, "Men's Fashion of the Times," September 13, 1992

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Winners this issue: Kevin White (Brother WP with Windows), Edward J. Thein (hard-earned cache), Rick Goddard (20 meg HD, sand blaster).

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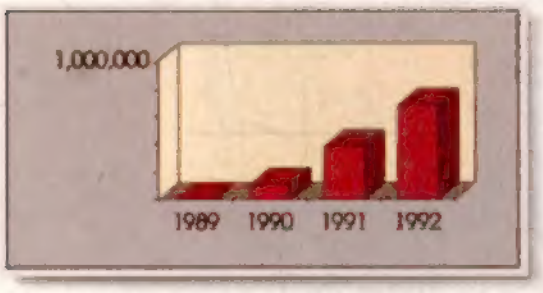
Then, to be sure that all of these features worked for WordPerfect users, we had them put to the test in the real world, with the help of the folks at the National Software Testing Labs.

From November 1989 to August 1992, over half a million WordPerfect users have switched to Microsoft Word for Windows.



After conducting in-depth tests in 10 cities, from Los Angeles to New York, the National Software Testing Labs discovered that for ease-of-use, nearly 8 out of 10 WordPerfect users chose Microsoft Word for Windows over WordPerfect for Windows.

But WordPerfect users aren't the only ones who prefer Microsoft Word for Windows. This year, it was awarded "Best Buy" by *PC World*. And the "Editors' Choice" by *PC Magazine*.

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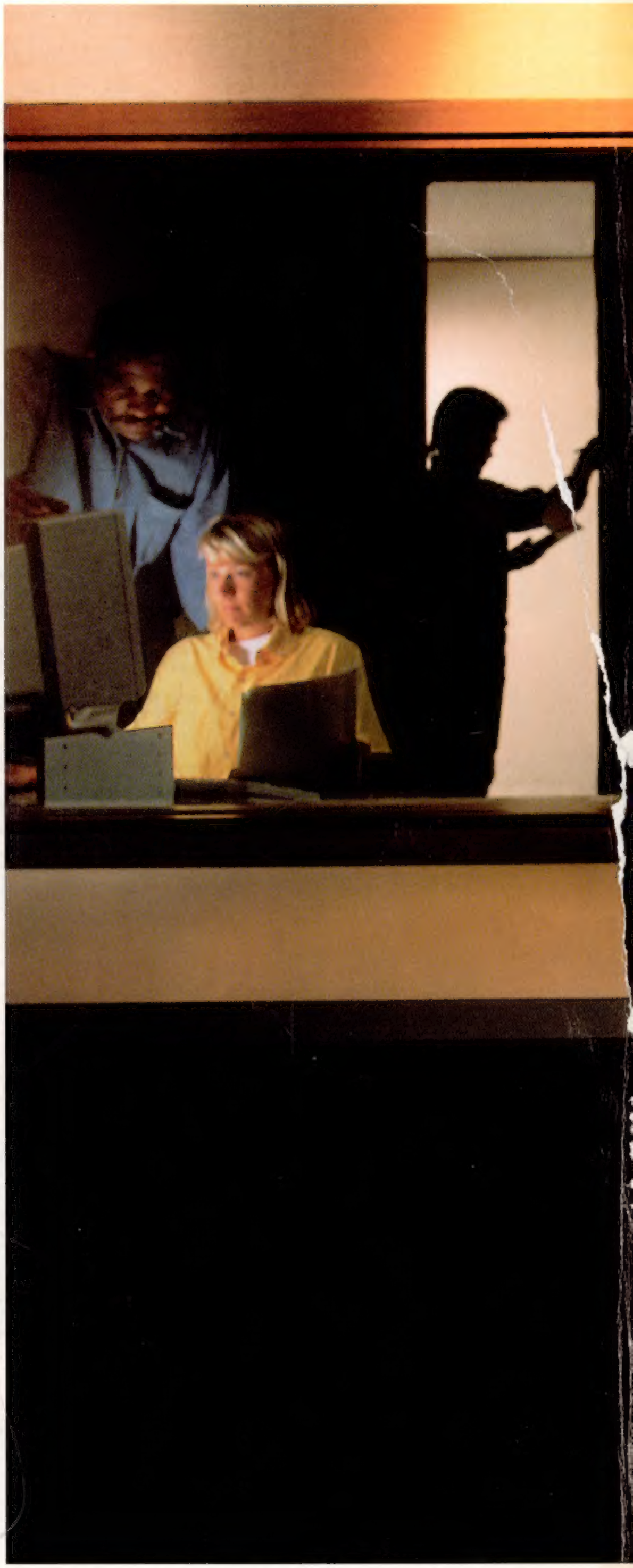

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